WARZYN

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VOLUME 1 OF 3

WORK PLAN (PSER/TS)

H.O.D. LANDFILL
ANTIOCH, ILLINOIS

AUGUST 1992

PREPARED FOR:
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SECTION 1
EXECUTIVE SUMMARY

The H.O.D. Landfill site (Site) is located in the Village of Antioch in northeastern Illinois. The Site was listed on the National Priority List (NPL) by the U.S. Environmental Protection Agency (EPA) on February 20, 1990. On August 20, 1990, an Administrative Order on Consent (AOC) was executed between the U.S. EPA and Waste Management of Illinois, Inc. (WMII), the Respondent, to conduct a remedial investigation and feasibility study (RI/FS) at the Site. The first step of the RI/FS is the development of this Work Plan (WP); consisting of a Preliminary Site Evaluation Report (PSER), documenting the investigative work completed to date, and a Technical Scope (TS), documenting the work to be performed. Available Site data and information were reviewed, compiled, and used to develop a conceptual model of the Site. Based upon that model, possible response actions were developed, and data which may be required to confirm/revise the model and further evaluate possible response actions were identified. The Site **conceptual model, possible response actions** and **data needs,** summarized below, are discussed in the body of this report.

Site Description

The Site appears as a visually continuous area, however, it encompasses adjacent "old" and "new" landfill areas, both covered with a four foot thick cap of compacted native clayey materials. The combined landfill areas cover 51 acres within the designated 80 acre Site. The "old" landfill consists of 24.2 acres situated on the western third of the property. The "new" landfill consists of 26.8 acres situated immediately east of the "old" landfill (see Drawing 60953-F1). Operation of the "old" landfill began in 1963 with the disposal of waste in trenches excavated into the native site materials. Cover was applied on an irregular basis at the "old" landfill to prevent blowing litter and to control odor. The area was also fenced to prevent indiscriminate dumping. As the "old" landfill expanded, Sequoit Creek was relocated to its current position along the southern boundary thence north along the west end of the Site.

Operation of the "new" landfill began with the installation of a clay barrier wall between the "old" and "new" portions of the landfill; installation of a leachate collection system, both along the eastern boundary of the "old" landfill and within the "new" landfill; and an allowance for flood storage along the southern extent of the "new" landfill. Wastes placed in the "new" landfill were covered on a daily basis with six inches of native clayey material. Where materials other than clayey soils were encountered in the bottom or walls of the "new" landfill, they were removed and replaced with a minimum of six feet and as much as 12 feet of compacted clay. The Site was closed in 1984.

The near surface geology in the Site area consists of a sequence of four unconsolidated units:

- Surface soils
- A surficial sand
- A clay diamict
- A deep sand and gravel unit

Surface soils are generally thin and consist of clayey to gravelly material and peat. The surficial sand is elongated in an east-northeast to west-southwest orientation that begins under the southeast portion of the "new" landfill, thickening in a southerly direction away from the Site. This surficial sand has not been developed as a water supply in the area of the Site. The surficial sand is underlain by a clay diamict which is laterally extensive and acts as a hydraulic barrier between the surficial sand and deep sand and gravel aquifer. The deep sand and gravel aquifer has been developed for both public (Village of Antioch) and private water supplies (Silver Lake subdivision).

A substantial amount of geologic and hydrogeologic information has been collected during previous investigations. Site lithology and groundwater flow characteristics are already well defined. As a result, possible RI data collection needs related to physical Site characterization are minimal.

Possible Response Actions

The full range of possible remedial actions appropriate at the Site will be evaluated during the RI/FS. Possible response actions for the Site will focus on the containment of leachate in the "old" landfill and, if necessary, the "new" landfill. Containment in the "old" landfill could be achieved by upgrading the clay cap and/or keying a barrier/cutoff wall into the underlying clay diamict in the southern portion of the "old" landfill to minimize the potential for lateral migration of contaminants from the Site. Additional response actions may be required to more effectively reduce the hydraulic head within the "old" and "new" landfills, enhance the collection and treatment of landfill gas, and control runoff from the Site. The need for such response actions will be identified as part of the RI/FS. In addition, pumping and treating groundwater in the surficial sand and gravel will be considered as a possible response action.

In conducting the RI/FS, the focus of activities will be to verify and/or revise (if necessary) the conceptual model and the possible response actions. However, potential sources, migration pathways (both on-Site and off-Site), and the nature and extent of contamination, if any, associated with the Site will be considered and evaluated. In light of the conceptual model, possible response actions, and the need to address the broader question of potential contaminant sources, migration pathways, and contamination characteristics (nature and extent); the data needs to be satisfied during the conduct of the RI/FS are discussed below.

Data Needs

As indicated previously, much investigative work has been conducted at the site. Additional data collection activities will focus on source characterization, physical site characterization, definition of nature and extent of contamination and possible response actions.

The RI will be conducted in two phases. The Phase 1 RI will consist of source characterization, physical site characterization, migration pathways assessment, and contaminant characterization. If required, additional data needs will be defined and data collected in Phase 2.

Source characterization activities will include:

- Drilling landfill borings
- Excavating test pits
- Installing leachate piezometers
- Installing multi-level gas probes

Physical characterization activities will include:

- Hydrogeologic evaluation, including:
  Drilling borings
  Installing monitoring wells and piezometers in the surficial sand and deep sand and gravel
  Monitoring groundwater and surface water levels
  Designing an appropriate groundwater sampling program
- Hydrologic evaluation
- Air evaluation
- Human population evaluation
- Preliminary ecological evaluation.

Migration pathway assessment and contaminant characterization activities will include sampling:

- Groundwater
- Surface Water
- Surficial soils and sediments.

The results of Phase 1 physical and source characterization, and migration pathways and contaminant characteristics studies will be presented in Technical Memorandum No. 1.

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SECTION 2
INTRODUCTION

Under an Administrative Order on Consent (AOC) issued by the U.S. Environmental Protection Agency (EPA) Region V, Waste Management of Illinois, Inc. (WMII), the Respondent, agreed to undertake a PRP lead Remedial Investigation (RI) and Feasibility Study (FS) at the H.O.D. Landfill site (Site). An initial step of the RI/FS, in compliance with the AOC Article VIII.C.1, is the preparation of a Preliminary Site Evaluation Report (PSER) and Technical Scope (TS). The PSER (Section 3.0) will describe the following from a review of available data:

- A history of Site activities
- An understanding of existing Site conditions
- A preliminary definition of any problem and its extent
- An identification of potential receptors
- A conceptual model of the Site

The TS (Section 4.0) will preliminary identify:

- Data deficiencies and needs, if any
- Probable remedial action objectives and possible response actions
- A proposed program to acquire and evaluate needed data, and to identify, screen and evaluate alternative remedial actions
- A framework for subsequent development and review of associated project plans, including preparation of a risk/endangerment assessment.

2.1 Background

In July 1984, Ecology & Environment, Inc. (E&E), a contractor to the U.S. EPA, conducted a Site inspection. That and other available information was used by E&E to rank the Site in April 1985 under the Hazard Ranking System (HRS). The Site was scored 52.02, primarily attributable to an "observed" release to groundwater and, to a much lesser extent, potential for surface water exposure routes. Based upon the HRS ranking, the Site was proposed by the U.S. EPA for inclusion on the National Priorities List (NPL) in Update 4, on September 18, 1985. From November 1986 to September 1989 the U.S. EPA, through its contractors, conducted additional investigations at the Site in response to public comments, including those provided by WMII. WMII contended the zinc detected in groundwater at well G103 was related to deteriorated galvanized casing. In January 1990 a second ranking of the Site was performed. The HRS score (34.68) was based in part on the occurrence of contaminants in the surficial sand. A release to the deep sand and gravel was not observed. Because the landfill was considered an adequately covered landfill, the surface water score was assigned a value of zero. The air route was scored zero in both evaluations. On February 21, 1990 (55 Fed. Reg. 6154), the H.O.D. Landfill was listed on the NPL.

In early 1990, WMII entered into discussions with the U.S. EPA regarding the conduct of an RI/FS under an AOC that was, following public review and comment, executed on August 20, 1990. In May 1990 Warzyn Inc. (Warzyn) was contracted by WMII to support the PRP lead RI/FS effort by compiling, reviewing, and preparing this PSER/TS for the Site. This PSER/TS is the first deliverable under the AOC.

Following approval of the PSER/TS by the U.S. EPA and concurrence by the Illinois Environmental Protection Agency (IEPA), Warzyn, with direction from WMII, will prepare a Health and Safety Plan (HASP) and a Sampling and Analysis Plan (SAP) consisting of a Field Sampling Plan (FSP) and Quality Assurance Project Plan (QAPP). Following approval of these documents by the U.S. EPA/IEPA, RI/FS activities will begin in accordance with an approved schedule.

2.2 Purpose and Scope

The PSER (Section 3) is a compilation of currently available data and information about the Site. The PSER depicts current Site conditions (Site conceptual model), identifies potential contaminants of concern, if any, and potential receptors. The PSER is structured to provide:

- A general description of the Site (Section 3.1)
- An understanding of the environmental setting in which the Site is located (Section 3.2)
- The basic engineered (constructed) features of the "old" and the "new" portions of the landfill (Section 3.3)
- A general definition of the potential contaminants of concern and boundary conditions that may influence contaminant migration (Section 3.4)
- An identification of potential human and environmental receptors (Section 3.5)
- A conceptual model of the Site that relates potential sources through migration pathways to receptors (Section 3.6).

The TS is the road map for work to be accomplished in completing the PRP lead RI/FS. The TS also provides the management strategy under which data needs will be identified and satisfied, and the mechanisms that will be put into place to promote communication, coordination, and problem identification/resolution. The TS is structured to:

- Identify potential data gaps based upon a review of the available data (Section 4.1).
- Specify data collection needs in the various environmental media (Section 4.2)
- Advance a management strategy that presents probable remedial objectives and possible response actions (Section 4.3)
- Define quality objectives as applied to both available and future data (Section 4.4)
- Document the major tasks to be accomplished in completing the RI/FS (Section 4.5)
- Identify the mechanism and timing of the request for identification of applicable or relevant and appropriate regulations (ARARs) pertinent to the Site (Section 4.6)
- Present the schedule for accomplishing the work (Section 4.7)
- Identify project management actions and responsibilities (Section 4.8).

References and information sources used in the preparation of this PSER/TS are presented in Section 5.

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SECTION 3
PRELIMINARY SITE EVALUATION REPORT

The PSER represents the compilation of readily available data and information pertinent to the environment in which the Site is located, and to on-Site and off-Site disposal practices which could potentially affect the environment. The PSER is structured to provide information on:

- Site description
- Environmental setting
- Site engineering
- Nature and extent of any problem
- Potential receptors
- A conceptual model of the site.

3.1 Site Description

The Site consists of a total 80 acres, 51 acres which have been landfilled. Although the landfilled area is visually continuous, it consists of two separate landfill areas, identified as the "old" and the "new" landfills. The "old" landfill consists of 24.2 acres situated on the western third of the property. The "new" landfill consists of 26.8 acres situated immediately east of the "old" landfill (see Drawing 60953-F1). The two landfill areas have been legally delineated and a division line established under a special condition of permits (No. 1975-22-DE and No. 75-329) issued by the IEPA, Division of Land Pollution Control.

3.1.1 Location

The Site is located within the eastern boundary of the Village of Antioch in Lake County in northeastern Illinois (Township 46 North, Range 10 East, Sections 8 and 9). The Site is bordered on the south and west by Sequoit Creek. The Silver Lake residential subdivision is located east of the Site and agricultural land, scattered residential areas and undeveloped land is located to the north. A large wetland area extends south of the Site from Sequoit Creek. Silver Lake is located approximately 200 feet southeast of the

Site. A large industrial park area (Sequoit Acres Industrial Park), constructed on former landfill and fill areas, is located west of the Site and borders Sequoit Creek. The Site location is shown on Figure 1.

3.1.2 Water Supply/Groundwater Use

The Village of Antioch obtains its water from five water supply wells screened in the deep sand and gravel aquifer. Village well locations are shown on Figure 2. Under normal operating conditions, the Village wells are automatically activated in alternating cycles when the water pressure from aboveground water storage tanks drops below a designated level; wells 1 and 4 operate simultaneously, as do wells 2 and 3. Well 5, when activated, pumps alone. The pumps in wells 3, 4, and 5 are rated at 500, 650 and 750 gallons per minute (gpm), respectively. Well 4 was pumped at 575 gpm during the U.S. EPA/USGS pump test. Wells 1 and 2 are reported to produce 150 and 250 gpm, respectively (Ecology and Environment, 1989). These wells are finished at depths ranging from 131 to 231 feet. Municipal well information is summarized in Table 1, and well construction reports are included in Appendix A.

The well construction report for Village well 4 indicates fill is present at that location. The nature of the fill was not specified on the well construction report. The Lake County Health Department reported that industrial waste and garbage had been disposed in this area. Monitoring well US3D, located approximately 100 feet east of well 4 (Drawing 60953-F2) indicates four feet of fill/refuse is present in this area.

Volatile organic compounds (VOCs) were detected sporadically at low levels in Village Well 4 during the period February 1 through September 13, 1989 (see Table 7). A discussion of this issue is presented in Section 3.4, Nature and Extent of Problems.

Village Well 4 is screened in the deep sand and gravel at a depth of 108 feet to 128 feet below ground surface. The gravel pack extends from a depth of 40 feet to 141 feet below ground surface. The clay diamict which separates the surficial sand (and surficial refuse at Village Well 4) from the deep sand and gravel is present at a depth of 23 feet to 80 feet below ground surface. The annular space seal (redi-mix concrete) was placed from ground surface to a depth of 40 feet. Therefore only 17 feet of redi-mix concrete separates the surficial sand from the gravel pack at this well. This seal may not be adequate to prevent migration of fluids through the drill hole annulus.

Video camera logging of Village Well 4 was conducted. Some areas of the well appeared to be badly pitted. *Additional evaluation of the results is being conducted.*

Prior to video camera logging of well 4, PELA removed approximately 80 to 100 gallons of oil from well 4 (a column of oil on top of the water table approximately 15 feet thick). The oil was apparently the result of a malfunctioning pump oiling mechanism. It is not clear how long the oil may have been present in the well. WMII has not conducted additional video camera logging or monitoring to determine whether this problem has been fixed, because well maintenance is the responsibility of the Village. Samples of the oil were collected with a teflon bailer prior to removing the oil. Analysis of the oil detected the presence of toluene (up to 35,170 ug/kg), xylenes (up to 1203 ug/kg) and ethylbenzene (up to 188 ug/kg). Vinyl chloride was not detected in the oil and it is not a degradation product of compounds detected in the oil. Analytical results are presented in Appendix F.

Prior to drilling and constructing well 4, three test holes (1-65, 2-65 and 3-65) were drilled in the Sequoit Acres Industrial Park area (see Appendix A for well logs). Each of these holes was drilled through the clay diamict into the deep sand and gravel. The holes were reportedly plugged with clay slurry (Patrick Engineering, 1989). If the clay slurry seals are not competent, the potential for groundwater movement through these plugged holes exists.

Privately owned wells in the Site vicinity are screened in the same (deep) sand and gravel aquifer used by the Village of Antioch or the dolomite aquifer. These wells are finished at depths ranging from approximately 85 to 250 feet. Well construction reports for nearby private water supply wells are presented in Appendix B.

3.1.3 Property Ownership and Land Use

Property ownership around the H.O.D. Landfill is shown on Figure 3. The area south of the landfill and adjacent to Sequoit Creek is classified as a wetland by the U.S. Department of Interior Fish and Wildlife Service and the Illinois Department of Conservation, based upon stereoscopic analysis of high altitude aerial photographs; this wetland area has not been field examined. Identified wetlands around the Site are shown in Figure 4.

East of the Site is the Silver Lake residential subdivision and Silver Lake. Potable water is provided to the subdivision by private water supply wells completed in the lower sand and gravel aquifer. Household wastewater is discharged to septic tanks. Agricultural land, scattered residential areas, and undeveloped land are located north of the Site. Undeveloped land north of the northeast section of the "new" landfill is owned by WMII and has been used as a borrow area for landfilling operations. West of the Site is the Sequoit Acres Industrial Park, a light industrial area in operation since at least the 1950s. The industrial park was constructed over an old municipal garbage dump and an old industrial dump operated by Quaker Industries. The location of these industries and the two dumps is shown on Figure 5.

Sequoit Acres Industrial Park contains at least five companies that are small quantity hazardous waste producers, five registered underground storage tanks ranging in size from 60 gallons to 200,000 gallons, and a fill area that was, at least in part, a waste dump (Cunningham Dump and Quaker Dump). Companies that are small quantity hazardous waste producers include:

- Quaker Industries
- Chicago Ink and Research Company, Inc.
- Galdine Electronics, Inc.
- Major Industrial Truck, Inc.
- Nu-Way Speaker Products, Inc.
- Roll Foil Laminating, Inc.

Patrick Engineering, Inc. (Patrick) has investigated the development and environmental history of the Sequoit Acres Industrial Park (Patrick Engineering, 1989). A discussion of the activities at Sequoit Acres is presented in Appendix G.

3.1.4 History of Operations

Ownership. Waste disposal activities began at H.O.D. Landfill in 1963 and continued through Site closure in 1984. The Site has been owned and operated by three distinct companies:

- Cunningham Cartage, Inc. (1963-1965)
- H.O.D. Disposal Inc. (1965-1972)
- C.C.D. Disposal, Inc. (1972 - present, including merger with WMII).

Murrill Cunningham, owner, operator, and president of Cunningham Cartage, Inc. operated a 20-acre landfill at the Site from 1963 until August 1965. The property was then purchased by John Horak and Charles Dishinger, who operated the Site under the name H.O.D. Disposal, Inc. In December 1972, the 20-acre landfill was conveyed to C.C.D. Disposal, Inc. and C.C.D. Disposal, Inc. purchased the adjacent 60-acres of land to the east of H.O.D. Landfill. WMII merged with H.O.D. Disposal, Inc., and C.C.D. Disposal, Inc. gaining ownership of the entire Site. H.O.D. Disposal, Inc. and C.C.D. Disposal, Inc. became subsidiaries of WMII through the merger. WMII operated the landfill from 1973 until 1984 when the Site was closed. During the time WMII operated the landfill, portions of the 60-acre property were opened for landfilling (Ecology and Environment, 1989). In January 1975, WMII donated two parcels of the 60-acre expansion property to the Village of Antioch, but retained rights to operate a landfill on each parcel for designated periods of time.

Waste Disposal Activities. Murrill Cunningham began operating a sanitary landfill on the 20-acre property in 1963 under a Lake County Health Department (LCHD) permit. Cunningham Cartage applied to LCHD for a permit to expand landfilling operations onto the adjacent land parcel. The permit was denied by LCHD because the adjacent area was not zoned for a sanitary landfill (Ecology and Environment, 1989).

In August 1965, H.O.D. Disposal, Inc. took over operation of the 20-acre landfill. H.O.D. Disposal Inc. operated under a LCHD permit from August 1965 through March 12, 1975 when the IEPA approved the state permit. In October 1965, H.O.D. Disposal, Inc. applied to LCHD for expansion of the landfill area to 80 acres. The application was rejected because of zoning. In 1971, all solid waste disposal facilities in Illinois were required by State law to obtain operator permits from IEPA. In October 1973, WMII submitted a zoning request to the Village Zoning Board for operation of an 80-acre landfill. WMII submitted a permit application to IEPA on June 26, 1974. The IEPA set a July 27, 1974 deadline for WMII to acquire a permit. The IEPA fined WMII $5000 in August 1974 for not having an approved permit. On October 21, 1974 the zoning request was approved and on March 12, 1975 the IEPA approved the development permit.

Development Permit No. 1975-22-DE issued by IEPA on March 12, 1975 allowed disposal of general solid waste, excluding liquid and special wastes, on the 60-acre expansion. The permit specified special conditions, including:

- Leachate collection
- A surveyed separation between the "old" and "new" landfill areas
- Groundwater monitoring
- Allowance for a compensatory flood storage area for Sequoit Creek overflow.

Between July 1975 and the closing of the landfill in 1984, various supplemental permits were granted by IEPA to WMII to modify development and operational permits for the Site. The supplemental permits include, but are not limited to:

- Installing a fence around the entire Site and a berm along the east side
- Modification of the leachate collection system (see Section 3.3)
- A change in the method of landfilling (see Section 3.3)

- An increase in depth on a portion of the landfill to install seals along the southern boundary (see Section 3.3)

- Various supplemental permits allowing disposal of special wastes.

A woven wire mesh fence with barbed wire was installed around the north, south and west sides of the Site with a locking chain-link gate across the access road. The east side was fenced with screened chain-link fence with barbed wire. Also on the east side, an 8-foot high clay berm with shrubs was constructed to further reduce noise and visual exposure to residences to the east.

During operation of the Site, permits were issued by the IEPA for the disposal of municipal waste and a variety of industrial wastes and special wastes. The industrial wastes and special wastes disclosed on the permits included, but were not limited to:

- Waste oils and chlorinated solvents

- Emulsions polymerization waste containing phenol, lead, and zinc

- Various industrial sludges and municipal waste water treatment sludges

- Baghouse dust and grinding sludge containing chromium, cyanide, and nickel

- Paint booth waste

- Waste filter cake and latex sludge containing cyanide, phenol, and zinc

- Water soluble coolant and oil waste.

Table 2 presents a summary of the industrial and special waste permits. Based on a review of WMII records, special permitted wastes account for approximately 2% of the total volume of wastes disposed.

In 1982, WMII applied to the IEPA for a supplemental permit to expand landfilling operations onto adjacent land to the north which had been used as a borrow area for cover materials. The permit application was denied. WMII then applied for a supplemental permit to raise final contours. The request was denied based in part on the argument from the Village of Antioch that the modifications would make it impossible to implement its plans to build a light industrial park over the H.O.D. Landfill. WMII appealed the decision through the Illinois judicial system to the Illinois Supreme Court. The court upheld the IEPA's decision to deny expansion. WMII ceased accepting waste for disposal at the Site in 1984.

3.1.5 History of Regulatory Agency Response Actions

In June 1981, WMII submitted to the U.S. EPA a Hazardous Waste Site Notification form as required by Section 103(c) of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). The form indicated solvents, heavy metals, and cutting and hydraulic oils may have been disposed at the Site, as well as municipal waste.

A Preliminary Assessment (PA) was prepared by the E&E Field Investigation Team (FIT) for U.S. EPA in 1983 (Ecology and Environment, 1983). The FIT conducted a Site Inspection (SI) on July 10, 1984. The FIT prepared a Hazard Ranking System (HRS) model score and submitted it to U.S. EPA in April 1985. The Site was scored 52.02 based, in part, on an "observed" release of contaminants from the Site to groundwater. The presence of zinc at a concentration of 2040 ug/L in a groundwater sample collected from monitoring well G103 (see Drawing 60953-F2 for location) was used to document the release of contaminants to groundwater. WMII contended that the zinc was related to a deteriorating galvanized steel protector pipe.

On September 18, 1985, U.S. EPA proposed that the Site be placed on the National Priorities List (NPL) as an uncontrolled hazardous waste site.

In 1986, Versar prepared a report titled "H.O.D. Landfill Responsible Party Search Draft Final Report" for the U.S. EPA.

An Expanded Site Inspection (ESI) was conducted by E&E during the period 1986 through 1989 resulting in an ESI report being submitted to U.S. EPA on September 22, 1989. The goal of the ESI was to respond to public comments related to the HRS score and proposed listing of the Site on the NPL; specifically, to collect data related to Site geology, hydrogeology, and groundwater quality including the contention that the deteriorating protective well casing caused the false appearance of a zinc release. Data collection activities conducted for the ESI are summarized on Table 3. In January 1990, the H.O.D. Landfill was rescored under the HRS resulting in a revised score of 34.68 based on the occurrence of contaminants in the surficial sand, but not in the deep sand and gravel. The ESI report indicated the high zinc concentrations during PA sampling may have been related to deteriorating galvanized steel well protector pipes. However, the report indicated that this premise could not be justified solely using the results of the ESI.

In February 1990, the Site was officially placed on the NPL. As a result, WMII and U.S. EPA negotiated an Administrative Order on Consent (AOC) to conduct an RI/FS at the Site. The AOC was finalized on August 20, 1990.

3.1.6 Previous Site Investigations

Several investigations have been conducted at the Site. These investigations are briefly discussed in the following paragraphs. Previous soil borings and water monitoring wells are shown in Drawing 60953-F3 and Drawing 60953-F2, respectively. Table 4 summarizes soil boring and monitoring well information, including dates constructed, company that supervised drilling and a brief description of each drilling event. Soil boring logs and well construction details for these wells are presented in Appendix C.

A soil investigation was conducted by Testing Services Corporation (TSC) in 1973 to assess conditions for the expansion of the landfill and the construction of an on-site maintenance building. Twenty-five borings were constructed (TSC, 1973).

TSC installed six groundwater monitoring wells (G11S, G11B, G14S, G14D, G102 and G103) for WMII in May 1974.

A hydrogeologic report for the proposed landfill expansion to the north was prepared in 1982 (McComas, 1982). The report was based in part on 26 soil borings drilled by TSC at the Site in 1981.

IEPA prepared a trend analysis report summarizing chemical analysis of samples collected from monitoring wells at the Site and submitted the report attached to a letter dated May 7, 1982 to the Illinois Attorney General's Office. The report summarized the analytical data collected between November 1974 and December 1981 from the six on-site monitoring wells (IEPA, 1982).

A PA was completed on February 11, 1983 by the FIT at the request of the U.S. EPA. The PA identified several data gaps including determination of waste quantity and information related to possible groundwater or surface water contamination.

An SI was conducted on July 10, 1984 by the FIT. Groundwater samples were collected from on-Site monitoring wells. Analysis of groundwater samples, particularly from well G103, reportedly revealed the presence of elevated concentrations of zinc, lead, and cadmium. Analysis of surface water samples did not reveal elevated levels of analyzed parameters.

Well G103 was replaced with well R103 on October 31, 1985 because the well pipe was damaged during removal of the well protector pipe. After consultation with IEPA, the galvanized protector pipe for well G103 was removed because WMII suspected that zinc detected in the groundwater sample collected by FIT during the July 1984 SI was the result of deterioration of the protector pipe, of which at least one section was constructed of galvanized steel. The presence of zinc in the groundwater was used by the U.S. EPA to document Site groundwater contamination in the first HRS package (1985).

Dames and Moore conducted a hydrogeologic assessment of the Site at the request of WMII. The assessment was described in a report dated November 12, 1985. The report provided a brief summary of past groundwater sampling activities and an evaluation of chloride, zinc, and total dissolved solids in samples collected from the Village of Antioch Well 4, monitoring well G103, and a leachate sample (Dames and Moore, 1985).

On January 9, 1986, IEPA collected groundwater samples from four residential wells located east of the Site. The samples were analyzed for nitrates, organic compounds and trace metals. The results of the chemical analysis indicated no maximum allowable concentrations for trace metals and no organic compounds were detected.

An ESI was conducted by the FIT (Ecology and Environment, 1989) during the period 1987 through 1989. The ESI consisted of the following activities:

- Review of existing records
- EM survey
- Drilling 15 soil borings
- Installing 13 monitoring wells
- Measuring groundwater and surface water levels
- Hydraulic conductivity testing
- Pump testing
- Soil and groundwater sampling and analysis.

A summary of ESI field investigation activities is presented on Table 3.

The Village of Antioch filed an eleven (11) count complaint in September of 1984 against defendants Waste Management, Inc., Waste Management of Illinois, Chemical Waste Management, Phillip Rooney, Peter Huizenga, Trygve Bakkom and James DeBoer. The original complaint was dismissed in its entirety upon the motion of the defendants.

In May of 1985, the plaintiff Village of Antioch filed its Amended Complaint. Thereafter, the defendants filed additional motions to dismiss this Complaint. The motion to dismiss was granted in part and denied in part. Defendants have denied the substantive allegations in each of the counts. Each of the counts of the law suit as stated within the Amended Complaint centers upon the rezoning of the subject property in 1973 through 1974 and upon the operations of the landfill from 1975 through its closure in 1984. The plaintiff claims that the ordinance rezoning the property is also a contract. Defendants strongly deny this allegation. Plaintiff further alleges that the defendants misrepresented how the landfill would be developed and operated. Defendants also strongly deny these allegations. Finally, plaintiff alleges that the landfill constitutes a nuisance.

During the period 1989 through July 1990, P.E. LaMoreaux & Associates, Inc. (PELA), on behalf of WMII, conducted various Site investigations related to the litigation between the Village of Antioch and WMII. These investigations included the following activities:

- Drilling borings
- Temporary piezometer and staff gauge installation
- Water level measurements
- Grain size and permeability testing of soil samples
- Domestic well inventory
- Geophysical logging
- Selected survey at Village of Antioch Well 4
- X-ray diffraction analysis of soil samples.

The objective of PELA's investigation was to fully characterize Site geology and hydrogeology. The results of investigation activities listed above were used to determine:

- The lateral and vertical extent of the surficial sand
- The lateral and vertical extent of the clay diamict which separates the surficial sand from the deep sand and gravel aquifer
- The direction of groundwater flow in the surficial sand and the deep sand and gravel aquifer
- The potential for hydraulic connection between the surficial sand and deep sand and gravel aquifer
- The relationship between the shallow groundwater flow system and Sequoit Creek
- The depositional history of glacial deposits in the Site vicinity.

Conclusions of PELA's investigation have been incorporated into Section 3.2 of this PSER and are referenced as appropriate.

Patrick prepared an Environmental Audit of Sequoit Acres Industrial Park in 1989 on behalf of WMII legal counsel. The purpose of the investigation was to identify potential contaminant sources within the industrial park and evaluate potential routes of contaminant migration. The investigation evaluated aerial photographs, published data on geology/hydrogeology, and history of land uses. Soil borings were performed to define site stratigraphy (See Appendix C for soil boring logs).

Patrick's findings regarding land use have been presented in Section 3.1.3. Patrick concluded that several potential sources of soil and/or groundwater contamination existed in the Sequoit Acres Industrial Park, including industry and landfilled areas containing both fill and refuse. The Patrick report further indicated "The isopach of refuse, Figure 13 [in the Patrick report], indicates that it is probable that the fill on the water well drillers log for well No. 4 was actually refuse."

Shallow borings were drilled at three locations on October 23, 1989 by Patrick for Geoservices Inc. of Boynton Beach, Florida to collect samples of the clay diamict. Geoservices conducted laboratory permeability tests on five clay samples collected from these borings (see Table 5).

Five temporary leachate piezometers (TLP1 through TLP5) were installed at the "old" landfill for WMII by Stratigraphics, Inc. on July 24 and 25, 1990 (see Drawing C690953-F4 for locations). Prior to piezometer installation, a piezometric cone penetration test was performed at each location to determine subsurface conditions. The stratigraphics report indicated clay underlies refuse at each of the temporary leachate piezometer locations. The cone penetration test logs are presented in Appendix C. Leachate samples were collected for laboratory analysis from temporary leachate piezometers TLP1 through TLP4 on July 27, 1990. Samples were collected from TLP2, TLP4, and TLP5 on August 10, 1990. Samples were analyzed for organics, metals and indicator parameters. Results are summarized in Appendix E.

Groundwater quality samples were collected by WMII at ten on-Site monitoring wells on July 25 and 26, 1990. Samples were analyzed for organics, metals and groundwater quality indicator parameters. Results are summarized in Appendix E.

Leachate samples were collected from the "new" landfill (east manhole, and leachate piezometers WP1, 22A, NP3A, P8, P9, and P10) and for the "old" landfill (west manhole) on June 28, 1990 samples were analyzed for organics. Results are summarized in Appendix E.

The U.S. Geological Survey (USGS), in cooperation with the U.S. EPA, performed an evaluation of the aquifer pump test data collected during the ESI Report and presented the results in a report titled "Determination of Hydraulic Properties In The Vicinity Of A Landfill Near Antioch, Illinois" (USGS, 1990). A USGS Administrative Report which was issued prior to the final report and which presents an abbreviated discussion of the test is presented in Appendix C.

WMII and Warzyn have evaluated the report and have prepared the following response which addresses several questions and concerns related to data interpretation. In summary, the results of the aquifer test indicates that the clay diamict is continuous throughout the area of the test as evidenced by the lack of water level response in wells screened in the surficial sand and gravel.

The report recognized that the aquifer test analysis methods chosen were not derived specifically for the hydrogeologic characteristics of the Site. Designing and analyzing an aquifer test at the Site is a difficult proposition because of the complex hydrogeology and the existence of operating municipal water supply wells. As a result several of the assumptions inherent in the chosen test analysis methods can not be met. Several specific concerns have been identified during our review of the report and are discussed below.

- The report states that "the data and analysis do not clearly show that water from the upper aquifer moved into the confining bed during the test." Yet the report concludes that if leakage from the surficial sand to the deep sand and gravel has occurred, contaminants present in the surficial sand could move into the deep sand and gravel aquifer. We believe additional study is required prior to hypothesizing on the potential for contaminant migration into the deep sand and gravel aquifer. The RI will define the extent of groundwater contamination resulting from the Site, if any.

- The deviation in drawdown from the type curve could be related to one or more of the following factors: presence of a recharge boundary (water body); leakage from confining layer; effects of partial penetration; nonuniform aquifer thickness; and presence of heterogeneous aquifer. The report assumed the deviation was due to leakage from the overlying confining unit and did not evaluate the other possibilities.

- Village Well 4 is not a fully penetrating well and is not sealed through the entire thickness of the clay diamict. As a result, drawdown data may be distorted to resemble a recharge boundary. In addition, the granular backfill surrounding the well screen and well casing extends up to within approximately 17 feet of the top of the clay diamict and the well seal is reported to be redi-mix concrete. The potential exists that the seal is inadequate and a preferential downward pathway for groundwater movement exists. Between April 27, 1992 and April 27, 1994, Waste Management of Illinois Inc. (WMII) must install a replacement well for the Village of Antioch. Three years after completion of the replacement well and integration of that well into the Village's existing drinking water supply, WMII will dismantle Village Well 4. The Village of Antioch will physically disconnect Village Well 4 from the existing water supply system when the replacement well is connected into the system.

- The aquifer is assumed to be of uniform thickness. The deep sand and gravel, in fact, varies in thickness by as much as 110 feet in the Site vicinity. The effect of an nonuniform aquifer thickness is that drawdown data may resemble those of a recharge or discharge boundary.

- The aquifer is heterogeneous, but the analysis method assumes it is homogeneous. If zones of relatively high conductivity exist in the test area the drawdown data may resemble those of a leaky aquifer.

- The clay diamict thickness is not uniform. The thickness near the Site ranges from 10 feet at boring LB10 to 129.5 feet at TSC boring 203. In the Hantush and Jacob (1955) method, the hydraulic conductivity of the confining unit is equal to the rate of leakage through the confining unit times the thickness of the confining unit. The USGS assumed the clay thickness was a uniform 25 feet.

- The clay underlying the deep sand and gravel is not impermeable (as assumed by the analysis methods) and leakage from below could cause the drawdown curve to depart from the type curve. As a result, the hydraulic conductivity of the clay diamict would be overestimated (the actual conductivity of the clay diamict would be less than estimated).

- Several exploratory borings were drilled through the clay diamict in Sequoit Acres Industrial Park by the Village of Antioch prior to drilling well 4. These borings were reportedly sealed with clay slurry. However the nature of the clay slurry is unknown and these borings may provide a preferential pathway for water to move from the surficial sand to the deep sand and gravel.

- The water level change at well US6I (screened in the clay diamict) was approximately 0.08 feet. This change may be related to barometric pressure change, pre-pump test water level trends and/or pumping of well 4. The USGS report assumed the change was related to pumping of well 4. The USGS report did present changes in barometric pressure along with changes in water levels (Figures 8 and 9 of USGS Report) and recognized the potential effects of partial penetration and surface water recharge when interpreting pump test data.

The most important conclusion which can be drawn from the USGS pump test report is that the clay diamict is continuous across the site and that it is characterized by low hydraulic conductivity. The report is inconclusive regarding the potential for contaminant migration from the surficial sand to the deep sand and gravel aquifer. Aquifer characteristics presented in the report are estimates because several assumptions used in the analysis were not met.

Additional investigation of Site hydrogeologic characteristic and potential contaminant migration pathways will be performed during the RI (See Section 4.4.3). In particular, a nest consisting of three wells will be installed in the vicinity of boring LB10 (See Section 4.4.3) to evaluate the potential for hydraulic communication between the surficial sand and the deep sand and gravel. Water levels will be monitored to assess the vertical flow component in the surficial sand and to compare heads in the surficial sand and deep sand and gravel.

Descriptions of Site conditions contained in this report are based, in part, on the results of the investigations described above.

3.2 Environmental Setting

3.2.1 Climate

The Site is located within a continental climatic belt characterized by frequent variations in temperature, humidity and wind direction. The average daily minimum temperature is 15°F in January and the average daily maximum is 83°F in July. The average annual precipitation is 32.5 inches. The wettest months are April through September (USDA, 1970).

3.2.2 Physiography

The Site is situated in the vicinity of the Wheaton moraine within the Great Lakes section of the Central Lowland Province. The topography in the area is generally characterized by gentle slopes with poorly defined surface drainage patterns, depressions, and wetlands. The maximum relief in Lake County is 340 feet.

The topography in the vicinity of the Site is generally flat. The most prominent topographic feature in the area is the landfill. The maximum elevation of the landfill is approximately 800 feet mean sea level (MSL). The elevation of Sequoit Creek is approximately 762 feet MSL. Maximum ground surface relief at the Site is approximately 40 feet.

3.2.3 Hydrology

Surface drainage around the Site is generally toward the Fox River, located approximately 5 miles to the west. Locally, surface water flows from the Site toward Sequoit Creek.

Sequoit Creek originally flowed northwest from Silver Lake to a point that is now the approximate center and northern boundary of the Site, where it then flowed west toward the Village of Antioch (see Figure 1). However, Sequoit Creek was rerouted to flow west from Silver Lake along what is currently the southern boundary of the Site sometime between 1964 and 1967. At the southwestern corner of the landfill, the creek was routed to flow north along the western boundary of the Site. Approximately 250 feet north of the northwestern corner of the Site, the creek flows toward the west approximately 2 miles before discharging into Lake Marie. Lake Marie eventually discharges to the Fox River. Based on aerial photographs and a 1960 USGS topographic map of the Site area, the eastern portion of the Site was shown as a wetland prior to landfill development.

3.2.4 Surface Soils

The following surface soil types were found at the Site prior to Site development and may still be present in undeveloped areas.

- Houghton muck, wet
- Morley silt loam
- Zurich silt loam
- Peotone silty clay loam
- Peotone silty clay loam, wet
- Mundelein silt loam
- Miami silt loam.

The Houghton muck, Peotone silty clay loam are classified by the USDA Soil Conservation Service (SCS) as hydric soils. The Zurich silt loam and Mundelein silt loam are non-hydric soils that may contain hydric inclusions (see Appendix H). The distribution of pre-development surface soils is illustrated on Figure 7. A brief description of each soil type follows.

The **Houghton** series consists of deep, level to depressional, very poorly drained organic soil that formed in fibrous plant remains deposited in swampy areas. The Houghton muck generally receives run off from surrounding uplands and is subject to ponding. The water table is at or near the surface most of the year.

The **Morley** series consists of deep, gently sloping to steep, well drained to moderately well drained soils that formed in thin silty deposits in the underlying calcareous glacial till. The Morley silt loam is generally found on tops of morainic ridges.

The **Zurich** series consists of deep, level to moderately steep, well drained to moderately well drained soils that formed in 2 to 3 feet of silty material and the underlying calcareous stratified silt and sand. The Zurich loam is found on outwash plains.

The **Peotone** series consists of deep, level to depressional, very poorly drained soils that formed in thick silt and clay, water deposited materials. These soils are in low areas throughout the county. The Peotone silty clay loam, wet, is subject to ponding from water that runs off surrounding uplands. The water table is at or near the surface most of the year. The Peotone silty clay loam is also subject to ponding, but is drained artificially.

The **Mundelein** series consists of deep, level to gently sloping, somewhat poorly drained soils that formed in 2 to 3 feet of silty material over calcareous stratified silt and sand. The Mundelein silt loam occurs on outwash plains mainly in the valley of the Des Plaines River.

The **Miami** series consists of deep, gently sloping to strongly sloping, well drained to moderately well drained soils that formed in thin silty deposits and the underlying calcareous glacial till. The Miami silt loam is generally found in morainal areas.

3.2.5 Geology

Regional Bedrock Geology. Lake County is located along the northeastern flank of a northwest/southeast trending structural high known as the Kankakee Arch. The bedrock surface of northeastern Illinois varies in depth from 90 to 325 feet below the ground surface (Woller and Gibb, 1976). The bedrock surface dips gradually toward the east and exhibits an uneven surface as the result of pre-glacial erosion.

Throughout most of Lake County, the uppermost bedrock unit is the Silurian dolomite of the Niagaran Series. This dolomite unconformably overlies Upper Ordovician, Maquoketa Group shales, and ranges in thickness from 0 to 270 feet. The Maquoketa Group is the uppermost bedrock unit in small isolated areas along the western portion of the county. The Maquoketa Group ranges in thickness from 100 to 240 feet and consists primarily of thick non-water-bearing shales. The Maquoketa Group is underlain by a sequence of Cambrian and Ordovician sandstones and dolomites which, in turn, overlie Precambrian granite rock. Bedrock stratigraphy is summarized in Figure 8.

Regional Glacial Geology. The bedrock surface in Lake County is completely overlain by thick sequences of glacial deposits. These unconsolidated deposits exhibit evidence of multiple episodes of glacial advances and retreats of late Wisconsinan glaciation. The surface topography of the area is characterized by a series of parallel, onlapping moraines and intermorainal valleys. This morainal complex is composed of deposits of the Wadsworth Till Member of the Wedron Formation. Deposition of the Wadsworth Till represents the last retreat of the Joliet Sublobe of the Lake Michigan Lobe (Willman and Frye, 1970). The moraines decrease in age toward the east and are onlapped by lacustrine deposits of the Lake Chicago plain. Figure 9 presents a generalized stratigraphic column, which summarized the glacial geology in the Site vicinity.

Approximately 90 to 325 feet of Woodforian age glacial deposits overlie bedrock in northeastern Illinois. The Wadsworth Till Member of the Wedron Formation is the primary unconsolidated deposit in Lake County and ranges in thickness from 5 to 150 feet. The Wadsworth Till Member is underlain sequentially by the Haeger Till Member and Tiskilwa Till Member. The Tiskilwa Till Member overlies the Racine Dolomite. A regional geologic cross section is presented on Drawing 60953-F5. The glacial deposits are discussed in order of deposition in the following paragraphs.

A reddish-gray, silty clay till (Tiskilwa Till Members) overlies the Racine Dolomite in the region. This till unit is generally regarded as the lowermost member of the Wedron Formation that is present in the area (Willman, 1971). The unit is interpreted to be basal till probably deposited by lodgement (Johnson, et. al., 1985). The Tiskilwa Till Member consists of a lower unit consisting of a sandy silt with clay and a massive main unit which consists of approximately equal percentages of sand, silt and clay. No Site borings have penetrated this unit.

In the vicinity of Antioch, the Tiskilwa Till Member is overlain by the Haeger Till Member of the Wedron Formation. The Haeger Till Member was deposited by the Harvard Sublobe of the the Lake Michigan Lobe, is laterally extensive and consists of sand and gravel outwash deposits with some clay rich diamicts present. Outwash and till deposits of the Haeger Till Member outcrop locally along the western edge of Lake County and westward into McHenry County (see Drawing 60953-F5).

The Wadsworth Till Member overlies the Haeger Till Member. The Wadsworth ice of the Joliet Sublobe advanced westward across Lake County entraining recently deposited lake sediment and Paleozoic shales and limestone, resulting in a clay-rich debris load. The ice advance terminated near the Chain of Lakes lowlands. As the ice retreated the clay-rich load was deposited as the Wadsworth Till. The Wadsworth Till is characterized by gray, fine-grained clay rich diamict, and interbedded, sorted silts, sands and gravels. Diamict is defined as poorly to nonsorted sediment containing a wide range of particle sizes, regardless of sediment genesis. The diamict is laterally extensive and is present near the surface in most of Lake County.

Site Specific Geology. The Site area is underlain by differentiated deposits of sand, gravel, and silty clay. Soil boring and monitoring well locations are shown on Drawings 60953-F2 and F3. Results of grain size analyses and permeability testing conducted on soils samples are presented on Table 5.

The unconsolidated deposits encountered by borings drilled at the Site consist of a depositional sequence of till and outwash deposits associated with the surficial Cahokia alluvium (Holocene) and underlying Wadsworth and Haeger Till Members of the Wedron Formation. The unconsolidated deposits are divided into four distinct depositional units, in order of increasing depth and age:

- Surface soils
- An elongated surficial sand (that includes deposition within the Wadsworth Till Member and post glacial sand) of limited vertical and lateral extent which is present near the southern boundary of the landfill
- A clay diamict (Wadsworth Till Member)
- A deep sand and gravel aquifer (Haeger Till Member).

A conceptual representation of glacial stratigraphy as it relates to the Site is shown on Figure 9. Each of these units is discussed individually in the following paragraphs.

Surface Soils

Surface soils include clayey to gravelly topsoil, peat, and fill material (disturbed soil). The surface soils range in thickness from approximately 2 to 9 feet.

Isolated lenses of silty sand and organic-rich clay observed overlying the surficial sand unit are representative of fine-grained, post-fluvial environments such as wetland or overbank deposits. A thin lense of sand and gravel exists near the surface north of the landfill. The lense does not appear to be really extensive and does not extend into the landfill area.

Surficial Sand

The surficial sand is limited in both vertical and horizontal extent, exhibits an elongated geometry and trends east-northeast/west-southwest along the southern boundary of the Site. The horizontal and vertical extent of this unit is illustrated on Drawing 60953-F6.

The top of the surficial sand begins at depths ranging from 7.5 to 20 feet below ground surface. The unit ranges in thickness from 0 to approximately 54 feet (boring LB4). The surficial sand generally consists of light brownish gray to dark gray, fine to medium grained sand and gravel. It is poorly to well sorted and contains angular to rounded gravel of mixed lithology.

Clay Diamict

The clay diamict is laterally extensive and is present beneath most of Lake County. The regional extent of the unit is shown on Drawing 60953-F5. The clay diamict represents deposits of the Wadsworth Till Member. The clay diamict is present beneath the entire Site based on borings drilled during previous investigations. The horizontal and vertical extent of the clay diamict in the vicinity of the Site is shown on Drawing 60953-F7.

The top of the clay diamict is present immediately beneath the surface soils along the northern boundary of the site and may be as deep as 60 feet below ground surface (boring LB4A) where it underlies the surficial sand south of the Site. The thickness of the clay diamict ranges from greater than 100 feet (north of the site) to 10 feet south of the "old" landfill (see Drawing 60953-F7). The clay diamict is typically massive, light gray to dark gray in color and contains thin, isolated, discontinuous silt seams and sand seams. Lenses of clay and gravelly clay exist within the diamict.

Deep Sand and Gravel

The deep sand and gravel is laterally extensive and is present beneath the entire Site. (See Drawing 60953-F5.) The full thickness of deep sand and gravel is not known, but the unit is at least 185 feet thick in the Site vicinity (Ecology and Environment, Inc. 1989). The upper portion of this unit consists primarily of medium to coarse-grained sand with some fine-grained sand and gravel. The unit is moderately well sorted and generally coarsens with depth. Lower portions of this unit are poorly sorted and contain greater percentages of gravel. The deep sand and gravel represents outwash deposits associated with the Haeger Till Member (Willman, et.al., 1975).

3.2.6 Hydrogeology

Regional Hydrogeology. There are three major aquifers in northeastern Illinois:

- The deep Cambrian-Ordovician aquifer
- The shallower dolomite aquifer of Silurian age
- Deposits of glacial origin (such as the deep sand and gravel aquifer at Antioch).

Producing units in the deep Cambrian-Ordovician aquifer include the Galena-Platteville Dolomite, Glenwood-St. Peter Sandstone, Ironton-Galesville Sandstone, and Mount Simon Sandstone. The Mount Simon is sometimes considered a separate aquifer because it is separated from the overlying Ironton-Galesville Sandstone by the Eau Claire Shale aquiclude. The shallower dolomite aquifer is separated from the deeper aquifers by the Maquoketa Shale. In some locations, the deeper sand and gravel directly overlie the shallower dolomite aquifer and the two units are hydraulically connected.

Of the bedrock aquifers, the Silurian dolomite is the primary source of groundwater in Lake County. However, the sand and gravel aquifers provide only slightly less groundwater than the bedrock aquifers (Illinois State Water Survey, 1976).

Sand and gravel deposits, which occur as confined, semiconfined and unconfined aquifers are fairly extensive throughout Lake County. However, the deep sand and gravel aquifer is confined in the area of the Site. The majority of the confined units are located in the western portion of the county. Many residential wells in the Antioch area, and the

Village of Antioch's public water supply system, obtain groundwater from glacially derived sand and gravel deposits. The sand and gravel aquifer (Haeger Till Member) used by the Village of Antioch, is recharged in the Fox River Valley, located approximately 4 to 5 miles west of the Site. The unit is present near ground surface in this area and water from precipitation, lakes, and the Fox River can enter the sand (see Drawing 60953-F5). Groundwater within this unit flows from this recharge area to the east toward Lake Michigan.

The shallow bedrock aquifer (the Silurian dolomite) is tapped by many public water utility systems in the county. The yield capacity of this aquifer varies depending upon interconnection of fractures and aquifer thickness (Woller and Gibb, 1976). The aquifer is recharged by the downward migration of water from the overlying glacial deposits where sand and gravel deposits are in contact with the bedrock surface.

The depth of wells in the deep aquifer averages about 1,300 feet, and many of the wells yield over 700 gpm. Wells in the shallow dolomite are set to an average depth of about 300 feet. Depths of wells in the sand and gravel are generally less than 140 feet. The highest yielding sand and gravel wells (greater than 500 gpm) are generally located in major valley systems. The generalized stratigraphy of rocks in northern Illinois are shown on Figure 8.

Site Specific Hydrogeology. As discussed in the previous section, three major aquifers underlie the Site. The following discussion focuses on the deposits of glacial or Recent origin. Water-bearing glacial or Recent deposits consist of the surficial sand, underlying clay diamict aquiclude and deep sand and gravel aquifer.

Slug tests were performed on monitoring wells by the U.S. EPA FIT to estimate horizontal hydraulic conductivity. Resultant hydraulic conductivity estimates are presented in Table 6. Constant head permeability tests were performed on samples from the clay diamict by the U.S. EPA, PELA and Geoservices and are presented on Table 5.

Groundwater level data was collected by PELA on four occasions: October 5, 1989, March 19, 1990, April 23, 1990 and July 24, 1990 (see Appendix E). A water table map for the surficial sand (Drawing 60953-F8) and piezometric surface map for the lower sand and gravel (Drawing 60953-F9) have been prepared to illustrate groundwater flow directions.

Surficial Sand. The surficial sand is present along the southern Site boundary and exhibits an elongated east-northeast/west-southwest trending geometry. The maximum thickness of the unit is 54 feet based on boring LB4. The horizontal and vertical extent of the surficial sand is illustrated on Drawing 60953-F6.

Water table conditions exist in the surficial sand. Groundwater flow in the sand is generally from the perimeter of the surficial sand deposit toward Sequoit Creek (See Drawing 60953-F8). Groundwater flow direction is influenced by Sequoit Creek which traverses the southern and western boundary of the Site. PELA installed shallow piezometers along the creek to evaluate surface water/groundwater interaction. Their evaluation indicated that shallow groundwater discharges to Sequoit Creek. Surface water levels and groundwater levels at these piezometers are plotted on Drawing 60953-F8. This evaluation is consistent with the interpretation of the U.S. EPA FIT.

The estimated horizontal hydraulic conductivity for the surficial sand ranges from 4.8×10^{-4} cm/sec to 7.0×10^{-3} cm/sec based on slug tests conducted by E & E.

Clay Diamict. The surficial sand is separated from the deep sand and gravel aquifer by the clay diamict based on borings conducted in the vicinity of the Site. The thickness of the clay diamict varies beneath the site. Borings (drilled by PELA, TSC, Patrick Engineering, and E&E), indicate a minimum thickness of 10 feet at boring LB-10 and a maximum thickness of 129.5 feet at TSC boring 203. Based on an isopach map of clay, the thickest portion of the clay is in the northeast part of the landfill. The lithologic description of the clay indicates that the clay is massive, plastic, and characterized by low hydraulic conductivity.

The clay diamict impedes movement of groundwater from the surficial sand to the deep sand and gravel aquifer, based on piezometric head levels observed in wells screened in each unit. Groundwater level data collected by PELA on April 23, 1990 indicate heads in the surficial sand ranged from approximately 761.6 to 764.5 feet MSL while heads in the deep sand and gravel aquifer ranged from 727.3 to 730.8 feet MSL. This head differential of approximately 30 feet substantiates the poor hydraulic communication between the surficial sand and the deep sand and gravel aquifer which results from low hydraulic conductivity of the clay diamict (see Table 5).

Horizontal hydraulic conductivities in the clay diamict were estimated to be 7.9×10^{-6} cm/sec and 8.0×10^{-6} cm/sec at wells US3I and US6I, respectively based on slug tests conducted by E & E. The vertical hydraulic conductivity of the clay diamict ranged from 1.0×10^{-8} cm/sec to 6.9×10^{-7} cm/sec, based on constant head permeability tests performed on samples collected from borings LB10, LB2, LB3, and LB4A by PELA (See Table 5). Constant head permeability tests conducted on clay diamict samples obtained from the Site by Geoservices Inc. resulted in vertical hydraulic conductivity values ranging from 9.0×10^{-9} cm/sec to 8.4×10^{-8} cm/sec using Site groundwater as the fluid and 8.5×10^{-9} cm/sec to 6.0×10^{-8} cm/sec using Site leachate as the fluid (Williams, 1990).

<u>Deep Sand and Gravel Aquifer</u>. The deep sand and gravel aquifer occurs beneath the entire Site based on Site borings. This unit has not been entirely penetrated at the Site and therefore its thickness is not known.

The deep sand and gravel aquifer is under confined or semiconfined conditions. As indicated previously, groundwater elevations in the deep sand and gravel aquifer range from approximately 727 to 731 feet MSL. The elevation of the aquifer top ranges from 674.2 feet MSL at piezometer PZ1 to 702.7 feet MSL at boring LB10.

Primary groundwater recharge to the deep sand and gravel aquifer occurs in the Fox River Valley where the aquifer crops out (See Section 3.2.6 and Drawing 60953-F5). As groundwater flows toward the east from the recharge area, the aquifer is confined by the clay diamict.

The groundwater flow direction in the deep sand and gravel aquifer is illustrated on Drawing 60953-F9. Based on data collected on April 23, 1990, a groundwater divide is located beneath the eastern portion of the Site. However, well PZ-2, which defines the location of the divide, is partially screened in the clay diamict. A deep well (W2D) will be installed along the northern boundary of the "new" landfill during the RI to measure the piezometric level in the deep sand and gravel. To the west of the divide, groundwater flow is toward the southwest corner of the Site. East of the divide, flow is toward the east, consistent with regional flow. The data indicates that the groundwater divide is caused by pumping of Village water supply wells. Groundwater east of the divide follows the regional groundwater flow direction while groundwater west of the divide is diverted toward the Village wells.

Water level data collected by the U.S. EPA FIT during September and October 1987 for the ESI suggested groundwater flow direction in the deep sand and gravel aquifer was influenced by pumping of Village wells 4 and 5. The groundwater flow direction on September 10, 1987 was toward Village well 4 and on October 28, 1987 was toward Village Well 5. Data collected during the December 1987 pump test indicated well US1D was affected by pumping of Village Well 4. Under these pumping conditions no groundwater divide existed beneath the Site.

The horizontal hydraulic conductivity of the deep aquifer is estimated to range from 1.1×10^{-3} cm/sec to 1.6×10^{-6} cm/sec based on slug test data collected by the FIT. The surficial sands is present only along the southern portion of the Site and is not used for water supply. The deep sand and gravel aquifer is used for water supply - by the Village of Antioch and nearby residences.

3.3 Site Engineering

3.3.1 "Old" Landfill

In 1963, Murrill Cunningham began placing waste in the northern portions of what is now referred to as the "old" landfill portion of the H.O.D. Landfill. Waste was placed into excavated trenches of unknown (probably varying) size. Cover was applied occasionally to prevent blowing litter and odor problems. When a trench was filled, the wastes were covered with excavated material from the next trench. A fence with a gate was installed to help eliminate indiscriminate dumping. However, based on site inspection reports prepared by the supervising sanitarian of the Division of Environmental Health, Lake County Health Department, the gate was left open overnight occasionally during the first years of operation and the landfill was left unattended during operating hours on occasion.

In 1965, H.O.D. Disposal Inc. took over the Site. The method of landfilling remained about the same. Sequoit Creek was diverted to flow along the southern and western boundaries of the present H.O.D. Landfill. The creek diversion provided more acreage to landfill and reduced contaminant release to Sequoit Creek. C.C.D. Disposal, Inc. took over the Site in 1972 and continued operation of the "old" landfill by the trench method. In 1973, WMII merged with C.C.D. Disposal and H.O.D. Disposal, allowing C.C.D. Disposal to continue landfilling activities. Landfill operations began to be conducted more consistently. Daily cover was applied to prevent blowing litter and odor problems, and burning was discontinued.

In June 1974, WMII applied to IEPA for expansion onto portions of the adjacent 60-acre parcel. A survey line was established at the eastern fringe of the 20-acre landfilled area when the new portion was under development. This line now designates the barrier between the "old" and "new" landfill portions of the Site.

3.3.2 "New" Landfill

Preparations for the "new" landfill began in 1975 when WMII received Development Permit No. 1975-22-DE. Operation of the "old" landfill continued while the development of the "new" landfill proceeded.

The development activities required before landfilling could begin in the "new" landfill included:

- Installation of a clay barrier wall between the "old" and "new" landfills

- Installation of leachate collection pipe and manholes on the east and west side of the barrier wall between the "old" and "new" landfills

- Construction of a compensatory flood storage area between Sequoit Creek and the area to be landfilled.

The compensatory flood storage area was provided to protect the environmental setting of Sequoit Creek and Silver Lake. Prior to the re-routing of Sequoit Creek, the swampy areas along its floodway provided a natural spawning ground for Northern Pike. Re-routing the Creek disturbed this natural breeding area. The compensatory flood storage area provides 27 acre-feet for seasonal overflow of Sequoit Creek, and was constructed by removing a portion of the northern bank of Sequoit Creek that was constructed to re-route the creek earlier.

Waste Placement. The method of operation for the "new" landfill was initially the trench method, but was changed in 1978 to the area method. The trench method utilized at the "new" landfill was comprised of 70 foot wide trenches extending from north to south across the area to be landfilled. Trenches were excavated at a 1:1 side slope down to an elevation of approximately 750 feet MSL. The depth of cuts below existing ground varied from 10 to 25 feet. The clay from the trench excavation was stockpiled and used for daily cover. Prior to excavation of a trench, the surface layer of peat and organic material was removed.

In 1978, the method of landfilling was changed to the area method. The area method eliminated the walls separating each trench. A continuous trench was dug with newly excavated clay being used for cover material. The surface layer of peat and organic material was still removed. Elimination of the clay walls between trenches provided more volume to place wastes without altering the integrity of the engineered containment system.

Waste was placed into cells in compacted lifts that comprised one days' receipts of waste. Some liquid wastes were dumped along with the solid waste. IEPA allowed liquid waste disposal at the Site as long as the liquids were spread across the solids. Each day, waste was to be covered with a minimum of 6 inches of clay. Daily cover within 100 feet of the landfill boundary was removed before more waste was placed over those areas.

A 6-acre portion in the northeastern corner of the landfill was operated as a deep trench area. Clay was needed for a seal along the southern edge of the landfill (see next subsection), and soil borings performed by TSC in 1981 indicated the northeastern landfill area had ample clay for this purpose. The deep trench area was excavated to approximately 720 feet MSL in three phases.

A minimum of 4 feet of compacted clay was placed over the refuse when filling was completed to the final elevation of about 790 feet MSL. Logs of confirmatory borings are contained in Appendix C7. The compacted clay was covered with a minimum of 4 inches of topsoil to support vegetation.

Clay Barrier and Seals. IEPA directed WMII to create a distinct separation between the "old" and "new" landfills. WMII constructed a 12-foot wide compacted clay barrier wall along the west side of the "new" landfill (between the "old" and "new" landfills) and extended east along the northern and southern limits of proposed fill. The clay barrier wall was extended upward and keyed into the clay cap. Clay barrier walls, keyed into existing natural clay, were installed in areas where sand and gravel were found. Clay barrier walls were keyed into the final clay cap when the cap was constructed.

In addition to the clay barrier walls, bottom clay seals were added in areas where the bottom of the landfill was found to be a material other than clay. A minimum of 10 feet of undisturbed natural clay was required, or else 6 feet of compacted clay was to be placed. The location of clay seals was estimated based upon soil borings drilled for the operational permit and supplemental permits.

A supplemental permit was granted in 1981 to increase depth across a 6-acre area in the northeastern corner and install bottom and perimeter seals along the southern boundary of the "new" landfill. Soil borings performed by TSC in February 1981 and landfill excavation disclosed an area along the southern boundary of the "new" landfill containing sand and silt layers not indicated by the original soil borings used in the operational permit application. The bottom and perimeter seals were built in accordance with the initial operating permit (10 ft of natural clay or 6-foot thick compacted clay seals, 12-foot wide compacted clay walls). Laboratory tests conducted by TSC on samples of the clay indicated permeability ranged from 7.3×10^{-8} cm/sec to 8.1×10^{-9} cm/sec. For further discussion of this surficial sand, refer to Section 3.2.5; refer to Drawing 60953-F6 for the lateral extent of this surficial sand.

To obtain material for the seals, modification of the bottom of excavation was necessary. The 6-acre deep trench area provided the extra clay for the additional seals. The clay seals were keyed into natural clay or previously constructed seals to provide containment of landfilled material.

Leachate Collection. When the clay barrier wall was constructed between the "old" and "new" landfills, the leachate collection system was started. A 6-inch perforated pipe was installed west of the barrier wall to collect leachate from the "old" landfill. The "old" landfill pipe was connected to a manhole (MHW). The bottom of MHW is at approximately 758.5 ft MSL. The leachate collection pipe west of the clay barrier wall is sloped to flow into MHW.

Another 6-inch perforated pipe was installed east of the clay barrier wall, running north and south along the western limits of the "new" landfill. The 6-inch perforated pipe was also extended east approximately 250 feet along the northern and southern limits of the new landfill. All of this piping is connected to a manhole (MHE) east of the clay barrier wall. The bottom of MHE is below the landfill base.

Initially, the subgrade leachate collection pipe was installed at least 140 feet ahead of the operating trench. Gas bubbles were observed in the manholes in 1978 and, to solve the problem, WMII modified the leachate collection system. The subgrade leachate collection pipe stopped approximately 250 feet east of MHE, and piezometers were installed at approximately 500-foot intervals along the outer limits of the fill.

Currently, six leachate piezometers (P1, P2A, P3A, P8, P9, and P10) are in place. The piezometers were installed to collect leachate and monitor leachate levels in the "new" landfill, and are now used for leachate extraction. The piezometers were installed to the bottom of the landfill in 1983 and 1984. Piezometers P2-P7 were removed and replaced with piezometers P2A and P3A in 1984 when it was discovered that piezometers P2-P7 were bent from filling operations. Drawing 60953-F4 shows the location of the leachate piezometers. Appendix C contains existing piezometer boring logs.

Leachate levels have been checked monthly since late 1983. Prior to 1987, no leachate was extracted. Leachate extraction began in 1987 and WMII has attempted to maintain the leachate head 2 feet below the downgradient groundwater level in well G11D since that time. As of July 31, 1990, more than one million gallons of leachate had been removed since that time (WMII personal communication, 1990). Extracted leachate is shipped off-Site by tanker trucks for treatment and disposal.

Piezometers are used to withdraw leachate. The piezometers are hooked to an automatic pumping system that constantly pumps leachate into a 2500-gallon accumulation tank. When the tank fills, the pumps shut off and the tank is emptied into a tanker truck. The pumps are set 1 foot from the bottom of the leachate piezometers.

A pump is placed at the bottom of each manhole to remove leachate and maintain a 2 foot head differential below downgradient groundwater. Leachate extracted from the manholes is pumped to a tank that is emptied into a tanker truck when filled. In winter, leachate is pumped directly from the manholes to a tanker truck to prevent freezing. The tanker truck is off-loaded on a daily basis in the winter.

<u>Gas Venting</u>. When modification of the leachate collection system was approved by IEPA, no provisions were made for collection of landfill gas. In June 1988, 14 gas wells were installed. The gas wells were drilled to the bottom of the landfill. The wells are hooked to individual flares. See gas well boring logs in Appendix C for details regarding gas well construction.

3.4 Nature and Extent of Problem

3.4.1 Problem Definition

Groundwater. The primary environmental concern at the Site identified during previous investigations is contamination of groundwater. The Site received an HRS score of 52.02 in 1985 based on an "observed" release of a contaminant (zinc) to groundwater. The revised HRS score of 34.68 (1990) was based in part on an observed release of contaminants to the surficial sand but not to the "aquifer of concern." Because of th presence of contaminants in the surficial sand, and the potential for downwarc movement of groundwater, there is a need to protect the "aquifer of concern" (deep sand and gravel aquifer).

Sampling of Site monitoring wells by the U.S. EPA FIT (E&E) was conducted on August 10 through 12, 1987 (Round 1); April 18 through 19, 1988 (Round 2); and May 19, 1988 (Round 3). The following VOCs, not attributable by E&E to lab or field contamination, were detected:

1,2 dichloroethene (Proposed MCLG is 70 ug/L)
(Round 1:trans, Rounds 2,3: total)

	Round 1	Round 2	Round 3
Well US4S	71 ug/L	69-100 ug/L*	not sampled
Well US6I	ND	ND	1.2 ug/L (J)

Trichloroethene (MCL is 5 ug/L)

	Round 1	Round 2	Round 3
Well US6I	7 ug/L	5 ug/L	5.3 ug/L
Well US6D	ND	ND	0.47 ug/L (J)

Benzene (MCL is 5 ug/L)

	Round 1	Round 2	Round 3
Well US7S	8 ug/L	ND	ND

ND = not detected
J = estimated concentration
* = multiple samples collected
MCL = maximum contaminant level
MCLG = maximum contaminant level goal

Samples collected by U.S. EPA FIT for analysis of inorganic parameters resulted in detection of ten analytes considered to be common groundwater constituents. Iron was detected at higher concentrations in wells screened in the surficial sand compared to the deep sand and gravel aquifer. Iron concentrations were higher in WMII wells compared to FIT installed wells. Zinc concentrations were also elevated in some WMII wells compared to FIT installed wells.

Groundwater quality samples were collected at on-Site monitoring wells by WMII on July 25 and 26, 1990 and were analyzed for organics, metals and indicator parameters. Leachate samples were collected by WMII on June 28, July 27 and August 10, 1990 and analyzed for organics, metals and indicator parameters. Results are presented in Appendix F. A hydropunch groundwater sample was collected approximately 10 feet north of US4S on May 4, 1990. The sample was collected from a depth of 20 feet below ground surface. Vinyl chloride and 1,2,-dichloroethene were detected.

The nature and extent of groundwater contaminants detected at the Site in the surficial sand has not been determined. Potential sources of groundwater contamination include:

- The H.O.D. Landfill
- Historical discharge of untreated waste by Quaker Industries
- The former Cunningham Dump located west of Sequoit Creek
- The former Quaker Dump located west of Sequoit Creek
- "Fill" areas in Sequoit Acres Industrial Park
- Industries in Sequoit Acres Industrial Park that used and/or generated hazardous chemicals.

Several of these potential sources are located west of Sequoit Creek and may be hydraulically separated from the Site by the creek. However, some of these potential sources could have affected the Site area prior to the re-routing of Sequoit Creek (see Figure 12).

Existing data do not demonstrate that contaminants detected at the Site are related to contaminants detected at Village Well 4. Low concentrations of VOCs have been detected sporadically at Village Well 4, which was drilled through refuse. The source of VOCs has not been determined.

Vinyl chloride has been detected sporadically (on eight sampling dates between February 1 and September 13, 1989) in Village Well 4, located approximately 350 feet west of the Site (see Table 7). 1,2-dichloroethene and trichloroethene were detected on one occasion, each at low levels (0.2 ug/L). The cause for these detections has not been established. The well was shut down temporarily for a period of two months. The well is currently in service.

Potential sources for VOCs detected at Well 4 include the Cunningham Dump. The well was drilled through refuse present in the Cunningham Dump. The potential exists for contaminants to migrate downward via the borehole annulus and into the well because of the well construction (refer to Section 3.1.2). In addition, approximately 80 to 100 gallons of oil was removed from the well by PELA prior to the video camera logging. The oil was apparently from a malfunctioning pump oiling system (refer to Section 3.1.2).

Additional discussion of groundwater quality will be provided in Technical Memorandum No. 1. Technical Memorandum No. 1 will describe the results of physical site characterization and source characterization and will discuss activities necessary to characterize the magnitude and extent of groundwater contamination, if any.

Soils. Forty-nine subsurface soil samples were collected by the U.S. EPA FIT (E&E) for the ESI. No VOCs attributable to the Site were detected. Phthalates and polynuclear aromatic hydrocarbons (PAHs) were detected. PAHs were detected off-Site (US2D) and on-Site (US4D and US6D). The ESI concluded soil sampling and analysis did not demonstrate impacts attributable to the Site. The Site is closed and has been covered with four feet of compacted clay. Therefore, the potential for on-Site contaminated surface soils is low.

Surface Water. Contamination of Sequoit Creek has not been demonstrated in previous investigations and the surface water route was scored zero in the HRS package. This potential migration pathway will be evaluated during the RI.

Air. Methane is being generated by the Site and high organic vapor analyzer (OVA) readings taken by WMII at Site groundwater monitoring wells located near the southern portion of the "old" landfill (wells US6S, US6D, R103, US4S, US4D, G102) suggest methane is present in soils near the perimeter of the Site. VOCs could migrate with the methane. The potential presence of methane and VOCs in the unsaturated soils, could affect groundwater quality. The potential for off-site methane migration may be limited by Sequoit Creek to the west and south and natural clays to the north and east. The U.S. EPA did not require the Field Investigation Team (FIT) to conduct air monitoring to determine if a release had occurred. Therefore, the air route was scored zero in the HRS package. This potential migration pathway will be evaluated during the RI.

3.4.2 Definition of Boundary Conditions

Site boundary conditions will be established during the RI to identify the areas of investigation. The boundary will be set so that subsequent investigations will encompass the area of contaminated media, if any, in sufficient detail to support subsequent remediation activities. The boundaries may also be used to identify areas of Site access control and Site security.

The boundaries of the investigation will extend to the limits of the impact associated with the Site, as defined in the AOC. Data generated during the Site investigation will be used to define the investigation boundaries. WMII will be responsible for obtaining clearance for off-Site work.

Potential off-Site contaminant sources have been identified (see Sections 3.1.3 and 3.6). Site investigation activities are not planned to address these potential sources.

3.5 Identification of Potential Receptors

3.5.1 Human

The primary potential route of contaminant migration is assumed to be through groundwater. Potential human receptors, if any, will be inventoried by assembling private and municipal water supply well logs (Appendices A and B) and general population data for the area served by the Village water supply.

If contaminants are present, area residents or Site workers could be exposed through dermal contact with any contaminated soil, leachate or water, or inhalation of airborne contaminants. The potential for exposure to contaminated sediments or surface water exists through contact with Sequoit Creek. Exposure could also occur through ingestion of contaminated soil or fish from Sequoit Creek. Potential for exposure to airborne contaminants through inhalation are not known.

3.5.2 Environmental

A secondary set of potential receptors is the biological community. If the biological community becomes a receptor of contaminants it could potentially have implications for the protection of human and animal health, as potential contaminants could be transferred in the food chain. No information is currently available to assess impacts on the biological community and wetlands functions.

3.6 Site Conceptual Model

3.6.1 Summary of Source and Site Characteristics

The H.O.D. Landfill appears as a visually continuous area, however, it encompasses adjacent "old" and "new" landfill areas, both covered with a four foot thick cap of clayey materials. The combined landfill areas cover 51 acres within the designated 80-acre site. The "old" landfill began operations in 1963 with the disposal of residential garbage and industrial wastes in trenches excavated into the native site materials.

Operation of the "new" landfill began with the installation of a clay barrier wall between the "old" and "new" portions of the landfill; installation of a leachate collection system, both along the eastern boundary of the "old" landfill and within the "new" landfill; and an allowance for flood storage along the southern extent of the "new" landfill. Where materials other than clayey soils were encountered in the bottom or walls of the "new" landfill, they were removed and replaced with a minimum of six feet and as much as 12 feet of compacted clay.

A conceptual Site model is presented graphically in Figure 13.

The near surface geology in the area of the Site consists of a sequence of four unconsolidated units:

- Surface soils
- A surficial sand
- A clay diamict
- A deep sand and gravel unit.

The surficial soils are generally thin and consist of clayey to gravelly material and peat. The surficial sand is elongated in an east-northeast to west-southwest orientation and begins under the southern portion of the Site, thickening in a southerly direction away from the Site. This surficial sand has not been developed as a water supply in the area of the Site. The clay diamict underlying the surficial sand is laterally extensive in the area of the Site and separates the surficial sand from the deep sand and gravel aquifer, based on both regional information and borings drilled during previous investigations. The full thickness of the deep sand and gravel aquifer is not known, but is at least 185 feet thick. The deep sand and gravel aquifer has been developed for both public and private water supplies, including the Village of Antioch and private wells in the Silver Lake residential development.

Groundwater flow in the surficial sand is generally from the perimeter of the surficial sand deposit toward Sequoit Creek. Existing data indicates groundwater in the surficial sand discharges to Sequoit Creek. Further evaluation of groundwater/surface water interaction is necessary during the RI. Based on groundwater elevations in the surficial sand and deep sand and gravel, the potential exists for movement of groundwater from the surficial sand to the deep sand and gravel. Groundwater flow in the confined deep sand and gravel aquifer is regionally toward the east. Locally, pumping of Village Wells 4 and 5 creates a gradient in the deep sand and gravel toward these two wells. The surficial sand is separated from the deep sand and gravel aquifer by the low permeability clay diamict.

A substantial amount of geologic and hydrogeologic information has been collected at the site. Site lithology and groundwater flow characteristics are already well defined. As a result, RI data collection needs related to physical site characterization are minimal.

The primary environmental concern at the Site is the potential for groundwater contamination. VOCs have been detected in on-Site monitoring wells screened in the surficial sand and gravel. Low concentrations of VOCs were also detected in well US6I (screened in the clay diamict) and well US6D (screened in the deep sand and gravel aquifer). VOCs have been detected at low levels on occasion in Village Well 4, screened in the deep sand and gravel aquifer. However, the surficial sand is separated from the deep sand and gravel aquifer by the clay diamict and a relationship between VOCs detected in the surficial sand and VOCs previously detected in the deep sand and gravel aquifer at Village Well 4 has not been demonstrated.

Several other potential sources of contamination exist in the Site vicinity including:

- Historical discharge of untreated waste by Quaker Industries
- The former Cunningham Dump located west of Sequoit Creek
- The former Quaker Dump located west of Sequoit Creek
- "Fill" areas in Sequoit Acres Industrial Park
- Industries in Sequoit Acres Industrial Park that used and/or generated hazardous chemicals.

The potential for releases from the former Cunningham and Quaker dumps into the surficial sand exists. Although the materials that may have been used for fill in the filled areas of Sequoit Acres Industrial Park are not known, the potential does exist that constituents in those fill areas could also migrate to the surficial sand.

3.6.2 Potential Migration Pathways and Exposure Routes

Potential sources, migration pathways, and the nature and extent of any contamination associated with the Site will be considered and evaluated as data is developed.

Potential contaminant migration pathways include:

- Groundwater in the surficial sand
- Discharge of groundwater to Sequoit Creek
- Groundwater in the deep sand and gravel aquifer
- Historical erosion of soils from the site and deposition of sediments on-Site
- Runoff of surface water
- Migration of dense non-aqueous phase liquids (DNAPLs), if present
- Off-Site migration of landfill gas (methane and VOCs)
- Emissions from the Site to air.

If contaminants were released from the Site, the most likely area to be affected would be the area south of the "old" landfill. This portion of the landfill was constructed and operated during the early to mid-1960's and construction documentation data is not available. If a contaminant release occurred to groundwater, the surficial sand would be affected. Contaminants would migrate with groundwater toward Sequoit Creek and discharge into the creek. The "new" landfill was constructed with a bottom seal consisting of 10 feet of natural clay or 6 feet of compacted clay and a 12-ft wide perimeter seal of compacted clay. Leachate is actively pumped from both the "old" and "new" landfills. The overall effectiveness of the leachate extraction system is not known.

The potential for downward movement of groundwater and potential contaminants is reduced substantially by the presence of Sequoit Creek (discharge zone) and the presence of the underlying low permeability clay diamict. The potential for fluid movement through the clay diamict will be evaluated during the RI.

The Site is capped with a minimum of four feet of compacted clay. Therefore erosion of contaminated material from the site is unlikely. However, prior to Site capping, the potential for erosion of soils and runoff of contaminated surface water existed.

As refuse decomposes methane gas is generated. The gas can migrate from the Site via perimeter soils (if unsaturated) or through the cap. A passive gas venting system currently exists.

Human exposure to contaminated groundwater could occur if contaminants reached village or nearby private water supply wells. Dermal contact with contaminated soil/sediment or surface water, if any, could occur through contact with Sequoit Creek. On-site workers or nearby residents could be exposed to contaminated air.

Each of these potential migration pathways will be investigated during the RI. Pathways deemed to be of concern will be investigated and the magnitude and extent of contamination, if any, related to that pathway defined.

4

SECTION 4
TECHNICAL SCOPE

The Technical Scope (TS) portion of this document provides a description of the rationale for and content of proposed RI/FS activities. An investigation approach has been prepared to address gaps in the existing data base and to provide adequate data to conduct a Risk Assessment and Feasibility Study. The TS also describes the goals and quality objectives of the RI data collection efforts. The TS contains discussion of the following topics:

- Site management strategy
- Data collection needs
- Data quality objectives
- RI/FS Tasks
- Request for ARAR notification
- Schedule
- Project management.

4.1 Site Management Strategy

4.1.1 Strategy Development

The management strategy presently being considered for the Site has been structured considering an understanding of current site conditions; historical operations, practices and engineering design, media likely to be impacted; and potential contaminant migration pathways as considered in the site conceptual model. This site management strategy focuses on the probable remedial action objectives likely to be set and the probable response actions that will be implemented to attain the specified objectives.

4.1.2 Probable Remedial Action Objectives

The potential hazard posed by the Site which caused its ranking and placement on the National Priorities List was related to the occurrence of contaminants in the surficial sand, but not in the deep sand and gravel aquifer. The substantial volume of previously conducted investigative work described in preceding sections of this report has not indicated the existence of other potentially significant hazards posed by the Site. Therefore, based on data currently available, the primary remedial action objective for the Site will be to limit off-Site contaminant release (if present) impacting groundwater to levels protective of human health and consistent with ARARs criteria.

Additional remedial action objectives may be developed, based upon the results of the RI and the Risk Assessment. These objectives will also be defined by Risk and ARARs criteria, and may include control of contaminant release, if any, to both human and environmental receptors. Additional remedial action objectives could include control of Site air emissions, control of off-Site surface water and sediment releases, and control or removal of groundwater affected by any contaminant release from the Site.

4.1.3 Possible Response Actions

Long Term Actions. Long term response actions are those anticipated to provide a permanent remedy for site contaminant control. These actions would be taken after completion of the CERCLA process and would be consistent with detailed evaluation criteria, Risk Assessment findings, and ARAR's criteria. The long term possible response actions defined in this section are intended to address the primary remedial action objective; control of potential off-Site groundwater releases. In addition, the response actions include measures to achieve control of off-Site gas and surface water/sediment release. The response actions include primarily containment and extraction/treatment technologies installed on the Site property. The possible response actions for the Site include the following:

1. No Action. No action for long term remediation is a possible response action, with acceptability governed by NCP and CERCLA criteria.

2. Physical and hydraulic containment of the "old" landfill area. This containment may be achieved by a combination of techniques, possibly including an upgrade to the cover to limit percolation, installation of hydraulic barriers to limit lateral sub-surface migration of contaminants, and control of the leachate head

levels within the landfill. Leachate head level control could be accomplished using a combination of extraction system withdrawals and extension of the hydraulic barriers to the clay diamict.

3. The physical and hydraulic containment of the "new" landfill area, possibly using techniques substantially different than for the "old" landfill area. It is possible that containment response actions for the new landfill area could be much less intensive than those for the old landfill, or may not be required at all.

4. Enhancement of the liquid extraction system for both the "old" and "new" landfill areas. This system would directly remove aqueous contaminants existing within the landfill, and would also provide hydraulic gradient control to limit the potential for off-Site migration, as described above. This system would include extraction wells and possibly extraction trenches, pipework and pumping systems, and a multi-stage treatment plant. Extracted leachate would be disposed of at the local POTW or trucked off-site for treatment.

5. Enhancement of the existing gas extraction/incineration system for all filled areas of the Site. This system could control release of gases generated within the landfill, and would provide high-efficiency destruction of any hazardous gas constituents via a high-temperature flare unit. Physical components of this system would consist of extraction wells, pipe conveyance systems, blowers and the flare unit. Supplemental fuel would be required for long-term operation.

6. Construction of a runoff/sediment control system for the Site. This system would control any releases documented in the RI or raised as important in the Risk Assessment, and would also comply with anticipated ARARs criteria related to stormwater management in forthcoming U.S. EPA regulations. The system would consist of runoff diversion swales and ditches to control and direct runoff discharge and sediment generated on-Site. The runoff collection system would discharge to one or more runoff holding/sedimentation basins. Depending on identification of any contaminants of concern and ARARs evaluation, these basins either function on a flow-through basis, or could be operated in a fill/draw system, with regular water quality testing. Discharge would be to Sequoit Creek.

Description of possible response actions given here must be qualified, since new data will be provided by the RI and the Risk Assessment. This new data may be of sufficient importance to alter the possible response actions listed above.

Short Term Response Actions. Short term response actions are those actions which can be taken prior to completion of the RI, and before full-Site remedies can be developed and approved. Considering reasonable engineering practicality and the primary Remedial Action Objective for the Site, short term response actions could include the following:

1. Increasing landfill leachate withdrawal to the maximum delivery capacity of the existing leachate collection system, to enhance inward hydraulic gradients and thus reduce gradients along the potential groundwater migration pathway. This response action would need to be analyzed for effectiveness prior to implementation.

2. Control of off-Site sediment and runoff release, should evidence of cap breach or other contamination be observed. This control could consist of recapping or runoff diversion to a fill/draw basin.

3. Sampling of downgradient private water supply wells contiguous to the site and municipal supply wells 3 and 5 (Well 4 decommissioned) (see Section 4.4.3, Phase 1 - Potential Migration Pathway/Contaminant Characterization).

4. Construction of a barrier to accomplish physical and hydraulic containment of leachate around the perimeter of the landfill.

4.1.4 Probable Sequence of Response Actions

The probable sequence of response actions is anticipated to be guided by several key factors. These include the need for interim actions, the acceptability of operable unit approaches to Remedial Action selection, evaluation of actual contaminant releases during the Remedial Investigation, and other potential constraints to implementation.

Given the uncertainties listed above, the probable sequence of remedial actions is anticipated to be as follows:

1. On-Site actions related to containment and leachate/gas extraction treatment and disposal, either on an operable unit ("old"/"new" landfill) or combined basis.

2. On-Site actions related to cover reconstruction from remedial actions listed above, including run-off and sediment control.

3. Off-Site remedial actions or actions related to the surficial sand.

4.2 Data Needs

4.2.1 Approach to Describing Data Needs

The Data Needs establish the objectives for data collection activities in the RI. These Data Needs occur in four main areas: Physical Site Characterization, Source Characterization, Migration Pathway and Contaminant Characterization, and Characterization oriented toward Remedial Action analysis. Data Needs for the RI were developed based on the following:

- Available data on historic operations and landfill construction
- Available hydrogeologic and hydrologic data and analyses
- Available analytical laboratory data
- The Site Conceptual Model
- The requirements of the AOC Work Plan for the Site and general EPA guidance documents
- The probable Remedial Action Objectives
- The possible Response Action characteristics.

The discussion of Data Needs presented in this Technical Scope report is based on the investigative sequence described in the AOC Work Scope for the H.O.D. Landfill Site RI/FS as modified by U.S. EPA comments dated May 8 and May 24, 1991. The work to be conducted under this Technical Scope (TS) includes:

1. Data collection for physical characterization of the Site, and for physical and chemical characterization of the source area.
2. Data collection and sample analysis to evaluate migration pathways and the extent of any contamination.
3. Data collection and sample analysis, for establishing the nature and extent of any contamination and the nature of the migration pathways.
4. Evaluation of Analytical Data Sufficiency, and development of plans, as necessary, for additional sampling and analysis. Additional investigation, if

required, would be oriented toward contaminant fate and transport objectives, or toward data collection for evaluation and screening of remedial action technologies. This work would be conducted under Phase 2.

The following sections describe the principal Data Needs for the Site, and the text and Table 8 describe data collection activities to be conducted in response to the Data Needs.

Based on the investigative sequence shown above, the specifics of data collection activities in response to Data Needs on the nature and extent of contaminant migration, if any, will not be determined until the Physical and Source Characteristics data is collected and analyzed. Therefore, the discussion presented below and in Table 8 on data collection and analysis parameters associated with migration Pathways and Contaminant Characterization will not be specific with respect to analytical parameters or sample locations.

4.2.2 Physical Site Characterization

The data needs regarding physical characterization relate to investigation of Site hydrogeology, hydrology, and environmental characteristics. The previous investigations of the Site are particularly useful in establishing these Physical Characteristics. This available data will be supplemented with limited addition RI field data collection, to satisfy the data needs described below. Refer to Table 8 for additional information on the collection activities and level of effort associated with each data need.

Hydrogeology. Hydrogeologic data needs are generally related to several detailed issues not fully described by investigation results already available. Subsurface conditions beneath the southern portion of the "old" landfill need further definition. The Stratigraphics report indicates clay is present beneath each of the five temporary leachate piezometers installed in this area. Additional refuse borings will be drilled to confirm this. Proposed data collection approaches are summarized in Table 8 and described in detail in Section 4.4.

Hydrologic Data. Principal data needs with respect to hydrologic parameters are confined to characterizing the flow regime of Sequoit Creek and to collecting meteorological data relevant to site hydrologic budget issues. These data needs are oriented toward evaluating the relationship between Sequoit Creek and the surficial sand, particularly in confirming the previous investigation results which indicate that Sequoit Creek receives groundwater discharge. This groundwater/surface water interaction issue will be very important in evaluating potential migration routes in the surficial sand. In addition, this issue will be important in evaluating potential effects any remedial actions could have on Sequoit Creek and on-Site wetlands. Details of the hydrologic data acquisition are summarized in Table 8 and presented in Section 4.4.

Environmental Data. Environmental data needs include the delineation of potential receptors of Site contaminant migration, and evaluation of environmental issues that could become significant ARARs constraints. Specifically, receptor data needs include the careful evaluation of human population characteristics related to public and private water supply consumption and characterization of the local ecologic environment for use in Baseline Risk Assessment evaluation of possible off-Site contamination migration. The extent of wetlands and flood plains, and flood storage requirements on the Site and adjacent properties will be important in defining the regulatory constraints on potential remedial actions. Details of data collection associated with these data needs are summarized in Table 7 and presented in Section 4.4.

4.2.3 Source Area Characterization

Source area characterization data needs include both the physical and chemical characterization of the "old" and "new" landfill areas. The overall data need is to evaluate the amount of waste present in the landfill and its chemical characteristics and physical characteristics regarding the ability of possible contaminants to migrate off-Site. Specific data needs include a landfill cap evaluation to evaluate potential percolation (leachate generation) rates, investigations to determine the in-place volume of refuse and the in-place volume of leachate in the two landfill areas, testing to determine the effectiveness of the existing leachate collection system, and chemical characterization of leachate quality, solid waste (especially in the "old" landfill) characteristics and landfill gas quality characteristics. In addition, on-Site soils and sediment quality will be evaluated in areas adjacent to the landfill areas. Data collection activities associated with these data needs are summarized in Table 8, and described in Section 4.4.

4.2.4 Migration Pathways and Contaminant Characterization

Data needs associated with evaluation of potential migration pathways that have been postulated for the Site will be refined based on evaluation of the physical characterization and source area characterization data. Data needs described here related to evaluation of potential contaminants of concern, or migration pathways may change based on initial data collection.

Currently the major issue associated with migration pathways and contaminant characterization is the thorough evaluation of the potential groundwater contaminant migration pathway. This potential contaminant migration pathway needs to be characterized both physically and chemically. Secondary data needs associated with potential migration pathways and contaminant characterization include the evaluation of other potential contaminant sources to the surficial sand and the evaluation of surface water and sediments within Sequoit Creek as a possible additional contamination migration pathway. Data collection activities associated with these data needs are summarized in Table 8. RI activities associated with potential migration pathways and contaminant characterization are described in Section 4.4.

4.2.5 Characterization For Remedial Action Analysis

Data needs associated with Remedial Action Analyses include acquisition of data for initial screening as well as detailed analysis of operable unit or whole-site remedial actions. The majority of data needs are associated with more detailed characterization of source area physical, mechanical and chemical characteristics for design of leachate treatment and the potential stabilization/solidification systems for the new and old landfill areas. This data will initially be utilized in the development of the Alternatives Array Document, and some or even all of the currently considered remedial actions may be subject to substantial change during development of this document. Specific data needs and data collection activities associated with remedial action analyses are summarized in Table 8 and the general approach to treatability studies and remedial action analyses is described in Section 4.4

4.3 Date Quality Objectives

4.3.1 Criteria for Data Quality Objectives

The establishment of Data Quality Objectives formalize the requirements for data accuracy, precision, completeness, representativeness and comparability. Precision and accuracy are criteria for which quantitative limits can be developed. Precision describes the degree to which data generated from replicate or repetitive measurements differ. Accuracy is defined as the difference between the value of the reported data and the true value of the parameter being measured. The Quality Assurance (QA) objective with respect to precision and accuracy is to achieve the established limits for the analyses required. Completeness, representativeness and comparability are qualitative criteria used to determine the degree to which sample data accurately represents the Site.

The overall QA objectives are to implement field sampling, chain-of-custody, and quality control reporting procedures that will provide legally defensible data from field investigations and laboratory analyses in a court of law. Quality control objectives for these data, as well as those collected for health and safety purposes, are to obtain reproducible data consistent with limitations imposed by measurement methods used. Specific procedures to be used for sampling, chain-of-custody, calibration, laboratory analyses, data reporting, internal quality control, audits, preventative maintenance, and corrective actions will be described in the Quality Assurance Project Plan (QAPP) as described in Section 4.4.

4.3.2 Data Quality Objectives for Physical Characterization

Data quality objectives for physical data acquisition activities are generally not as easily documented with respect to either defined QA/QC levels or Precision, Accuracy, Representativeness, Completeness and Comparability (PARCC) goals as chemical characterization data. These physical data collection tasks and procedures are governed by Standards of Practice, but specific sampling and analysis PARCC goals are developed on a site and activity-specific basis. Physical data collected will be both quantitative and qualitative, and may be used for either qualitative interpretation (such as geologic material depositional environment) or quantitative (such as groundwater or surface water hydraulic model analyses) purposes.

The overall data quality objective is to provide defensible, representative data on the physical environment, which can be used in Risk Assessment and Remedial Action analyses. This data quality objective will be achieved by conduct of all field data acquisition using Standard Operating Procedure (SOPs) which are oriented toward RI/FS level investigation.

Typically, these physical characterization data collection SOPs are based on industry-accepted procedures produced by organizations such as ASTM, USGS, Corps of Engineers, U.S. EPA, and others. These technical procedures are then supplemented with appropriate Health and Safety actions, data reporting and project management functions to be capable of CERCLA/NCP review. SOPs for the defined data collection activities summarized in Table 8 will be established. These SOPs will discuss data quality objectives and will be incorporated into the QAPP as described in Section 4.4.

4.3.3 Sampling/Analysis Data Objectives and Quality Control

Data collection activities and data quality objectives for sampling/analysis work on the Site are presented in Table 8. Specific QA/QC and reporting requirements associated with data quality objectives for sampling/analysis data have been established for various RI/FS investigation activities. These data quality objective levels are defined in Table 9.

The quality of data from the field sampling program for laboratory analyses will be evaluated through the collection of field duplicates, field blanks and trip blanks. Bottle blanks will also be analyzed to serve as a check for bottle contamination. Duplicates will be used to assess the combined effects of sample collection, handling and analysis on data precision.

Analysis of groundwater, surface water, leachate, soil and sediment samples for TCL organics will be performed using Contract Laboratory Program (CLP) protocols. Levels of QC effort for these analyses are described in CLP Statement of Work SOW 2/88 (or most current). Analysis of groundwater, surface water, leachate, soil and sediment samples for TAL inorganics will also be performed using CLP protocols. Levels of QC effort for these analyses are described in the CLP Statement of Work SOW 7/88 (or most current). Sediment samples will also be analyzed for total organic carbon (TOC) and grain size.

Analysis of groundwater, surface water and leachate samples for general water quality indicator parameters will be performed using established procedures. QC requirements will include, where applicable, matrix spikes, laboratory duplicates, blanks, calibration check standards and EPA reference samples.

4.3.4 Accuracy, Precision and Sensitivity of Analyses

The QA objectives for laboratory and field analyses with respect to accuracy, precision and sensitivity are to achieve acceptable data based on specified performance criteria. Accuracy and precision requirements and method detection limits for TCL organics are described in the CLP Statement of Work SOW 2/88. Accuracy and precision for TAL inorganics are described in CLP Statement of Work SOW 7/88. Precision of laboratory analyses is judged from results obtained from laboratory duplicate analyses.

In addition to laboratory QC samples, field QC samples will also be collected. These will include both duplicate and blank samples. Variability in duplicate samples will reflect combined effects of both sampling and analytical error. Blank samples will be used to assess cross contamination associated with sampling activities.

Completeness is defined as the proportion of data collected that meet project specific acceptance criteria. It is anticipated that the great majority of the data collected will meet acceptance criteria. If required performance criteria are not met by performing laboratories, they will reanalyze samples if holding times permit.

Sampling, preservation and analysis methods are designed to provide analysis results that are representative of the sample matrix at the point of collection. The potential exists for considerable spatial heterogeneity in parameters measured at the Site. Hence, the degree to which the sampled locations represent the population of potential sampling points cannot be stated precisely. Consequently, no quantitative expression of representativeness is usually proposed.

4.4 RI/FS Tasks

The RI/FS will consist of 15 tasks as specified in the June 27, 1990 Scope of Work attached to the AOC.

The objectives of the RI are to:

- Identify the source(s) of potential contamination
- Characterize potential on-Site contaminant sources ("old" and "new" landfills)
- Characterize the Site hydrogeologic and physical setting, characterize possible contaminant sources, their nature and extent; evaluate the most likely potential contaminant migration pathways; and assess physical features that could affect potential remedial actions
- Determine the characteristics, migration rates, and extent of any contaminants of concern present at the Site
- Gather data to the extent necessary to quantify risk to public health and the environment
- Support the development and evaluation of remedial alternatives in the FS.

The first step in the RI/FS process is the preparation of this Work Plan consisting of the PSER and TS and other project plans (HASP and SAP, which includes the FSP and QAPP). Project planning for the RI/FS includes two tasks:

- Task 1: Work Plan and Investigation Support
- Task 2: RI/FS Project Plans

The RI consists of six tasks as follows:

- Task 3: Site Investigation
- Task 4: Site Investigation Analysis
- Task 5: Baseline Risk Assessment
- Task 6: Treatability Studies
- Task 7: Reports
- Task 8: Community Relations Support.

Potential remedial action (RA) alternatives will be assessed throughout the RI/FS process. If appropriate, RA activities will be categorized as operable units and interim actions will be conducted under:

- Task 9: Conduct Interim Actions

The purpose of this FS is to develop and evaluate remedial alternatives, based on information contained in the RI, that protect human health and the environment, and present the relevant information needed to allow for the selection of a Site remedy. The FS is comprised of the following tasks:

- Task 10: Development of Remedial Action Alternatives
- Task 11: Screening of Alternatives
- Task 12: Treatability and Supplemental Remedial Investigations
- Task 13: Detailed Analysis of Alternatives
- Task 14: Feasibility Study Report
- Task 15: Community Relations Program.

Each of the RI/FS tasks are discussed in the following sections.

4.4.1 Task 1: Work Plan and Investigation Support

Task 1 of the RI/FS encompasses the preparation of the Work Plan and investigation support activities. The Work Plan required for the preparation of that document and conduct of the RI/FS includes a compilation and summary of available Site information in the form of a PSER and identification of investigative and evaluative work proposed to be performed in conducting the RI/FS. These data needs and planned actions are presented in the technical scope (TS) portion of the PSER/TS Work Plan. Investigation support activities include:

- Site mapping
- Metes and bounds
- Access arrangements
- Preparation of support facilities.

The Site topographic base map has been prepared based on aerial photography performed on January 15, 1990. The base map has a scale of one inch to 100 feet and a contour interval of two feet. Pertinent physical features are shown on the base map (refer to Drawing 60953-F1). A legal description of the Site will be assembled from existing records prior to beginning the RI and will be presented in Technical Memorandum No. 1. Access arrangements necessary to facilitate Site investigation activities will be made by WMII after the U.S. EPA approval of the PSER/TS Work Plan. Necessary support facilities will be arranged when investigation activities have been approved by the U.S. EPA. Decontamination facilities will then be constructed on-Site. Necessary utility hookups will be made and Site control stations established as appropriate.

Based on available information, it appears that the north sidewall of the "old" landfill extends north of the fence line. Waste is covered by four feet of compacted clay and therefore there is limited potential for direct contact with waste (i.e., intrusive action would be required to expose waste material). Interim remedial measures such as moving the fence are being evaluated by WMII.

4.4.2 Task 2: RI/FS Project Plan

Specific project plans for implementing the Site investigation will be prepared after U.S. EPA approval of the PSER/TS. These plans include the following:

- Sampling and Analysis Plan
  - Field Sampling Plan
  - Quality Assurance Project Plan
- Health and Safety Plan
- Risk/Endangerment Assessment Plan
- Data Management Plan
- ATSDR Health Assessment.

These documents will be prepared in accordance with the Scope of Work attached to the AOC.

4.4.3 Task 3: Site Investigation

Investigations necessary to characterize the site and its potential hazard to public health and the environment will be conducted. Investigation activities will focus on problem definition and data collection to support the baseline risk assessment and development and evaluation of alternatives. Detailed descriptions of sampling methodology will be presented in the Sampling and Analysis Plan (SAP).

As discussed in Sections 4.2 and 4.3, the RI will be conducted (in accordance with the AOC) in two general Phases. The Phase 1 RI investigation will consist of fieldwork and analysis to address the following:

- Physical characterization
- Source characterization
- Migration pathway assessment
- Contaminant Characterization

Phase 2, if required, will consist of limited scope field work to provide additional data to evaluate site conditions/characteristics required to complete the feasibility study.

Phase 1 site investigation activities are presented on Tables 8 and 9. Locations are shown on Drawing 60953-F10. Physical characterization and source characterization will be conducted first to describe physical site conditions, define potential contaminant migration pathways and describe physical and chemical source characteristics. Potential migration pathways will be assessed and the nature and extent of contamination in pathways of concern will be evaluated. This will include Phase 1 sampling of groundwater, surface water, surficial soils and sediments. Technical Memorandum No. 1 will summarize the results of physical and source characteristics and will describe potential migration pathways and potential contaminant characteristics.

Phase 1 - Physical Characterization.
Physical characterization will be conducted to describe existing Site conditions and to formulate an appropriate Site monitoring/sampling program. Physical characterization will include:

- Hydrogeologic evaluation
- Hydrologic evaluation
- Soil and sediment evaluation
- Air evaluation
- Human population evaluation
- Ecological evaluation.

Hydrogeologic Evaluation. A hydrogeologic evaluation will be performed to further evaluate subsurface conditions and groundwater flow conditions. This investigation will include eight additional borings and installation of four additional monitoring wells (see Drawing 60953-F10 and Table 8). Wells installed during Phase 1 are for definition of physical hydrogeologic characteristics (i.e., groundwater flow direction, hydraulic conductivity) and for groundwater chemistry.

The boring at location MW1S will be drilled to collect additional data on the surficial sand. The boring will be drilled to the base of the surficial sand in the area southeast of the Site. If the surficial sand is saturated, the boring will be instrumented with a shallow piezometer to measure water levels.

Five of the proposed leachate piezometer borings (LP9 through LP13) will be installed in the southern portion of the "old" landfill, to evaluate subsurface conditions beneath the southern portion of the "old" landfill (also refer to Phase 1-Source Characterization).

A deep well (well W2D) will be installed in the deep sand and gravel along the northern boundary of the "new" landfill. This well will have a five foot long screen that is installed at least five feet below the base of the clay diamict. This well is being installed to measure the piezometric head in the deep sand and gravel.

A piezometer nest (W3S/W3D) will be installed south of the "old" landfill in the area where previous borings suggested the clay diamict is thinnest. The nest will consist of two shallow piezometers (W3SA and W3SB) screened in the surficial sand and a deeper piezometer (W3D) screened in the deep sand and gravel. Piezometer WS3A will be screened at the water table and piezometer WS3B will be screened at the base of the surficial sand. A sample of the clay diamict will be collected from both borings W3D and W2D and analyzed for laboratory hydraulic conductivity, total organic carbon, and porosity to evaluate the potential for fluid movement and attenuation of potential contaminants. Water level measurement data will be collected from piezometers (W3SA, W3SB, and W3D), to assess the continuity of the clay diamict in this area. These water level measurements will be collected concurrently with site-wide water level measurements.

A well (W4S) will be installed on the west side of Sequoit Creek on or near the Quaker Industries property to confirm the lateral extent of the surficial sand and to evaluate groundwater flow direction on the west side of Sequoit Creek. Gaining access to a drilling location in this area may be difficult because the property is owned by Quaker

Industries. In addition, refuse has been disposed in portions of this area and it is not recommended that a well be installed through refuse.

A shallow water table well (W5S) will be installed adjacent to existing well US4S. This well will be screened across the water table to monitor potential contaminants at the water table surface. Existing well US4S is screened approximately eight feet below the water table surface.

Similarly, a shallow water table well (W6S) will be installed adjacent to existing well US6S to monitor the water table surface. Well US6S is screened approximately 32 feet below the water table surface. One deep monitoring well (W7D) will be installed on-Site north of well US1D along the eastern boundary of the Site. This well will be screened in the deep sand and gravel and will monitor groundwater quality between the Site and private water supply wells.

WMII will evaluate the potential for dense non-aqueous phase liquids (DNAPLs) based on the results of leachate and groundwater sampling conducted during Phase 1. If Phase 1 results suggest the potential for DNAPLs exists, an appropriate investigation will be conducted.

Each of the borings to be drilled outside the landfill will be drilled using standard penetration split spoon sampling techniques. Soil samples will be collected continuously and will be classified by a geologist in the field. Grain size analyses will be conducted on selected soil samples to confirm the field classification. The number of soil samples submitted for grain size analysis will be determined based on the lithology encountered at each boring. At least one sample of each distinct lithologic unit encountered at each boring will be submitted for grain size analysis. Soil samples previously collected by both U.S. EPA and PELA will be observed if possible so that consistency of descriptions is maintained.

Water level measurements will be obtained from Site monitoring wells every other month for a period of one year from the start of field activities. Groundwater level measurements will be obtained concurrently with surface water level measurements.

The Village will be requested to provide municipal well pumping schedules for the two days prior to water level measurements and during the day measurements are taken.

Single well in-situ hydraulic conductivity tests have been performed at the Site during previous investigations. Hydraulic conductivity tests will be repeated at wells US3S, US3D, US4S, US4D, US6S, US6D, and US1S. These locations were chosen to re-evaluate hydraulic conductivity of the surficial sand (wells US1S, US3S, US4S, and US6S) and deep sand and gravel (US3D, US4D, and US6D) near the southern boundary of the "old" landfill (US4S, US4D, US6S, and US6D) and near Village well 4 (US3S and US3D). In addition, tests will be performed at new wells (W4S, W5S, and W7D). The resultant data will be used in conjunction with existing hydraulic conductivity data (See Tables 5 and 6) to assess groundwater flow rates. New borings and the monitoring well will be surveyed for location and elevation. Site grid coordinates will be established and borings/wells plotted on the Site base map.

Hydrologic Evaluation. A hydrologic evaluation will be conducted to confirm the connection between groundwater in the surficial sand and surface water and to evaluate the potential for surface water contamination. The relationship between the surficial sand and the clay diamict will be evaluated based on results of both the hydrologic and hydrogeologic evaluations. The investigation will include measuring surface water levels in Sequoit Creek, measuring flow in the creek, and inspecting the creek banks. An estimated hydrologic budget will be prepared for the on-Site wetlands to determine whether future potential remedial accounts could alter the wetlands hydrologic regime.

Water level measurements will be obtained at existing staff gauges PSG1, PSG2, PSG3 and PSG4 (see Drawing 60953-F2 for locations). Measurements will be taken on the same dates as groundwater level measurements. Sequoit Creek flow measurements will also be made at PSG1 and PSG4.

Surface water elevations at existing staff gauges (PSG1-PSG2) will be compared to groundwater elevations at existing piezometers (SC1A-SC4D). Refer to Drawing 60953-F8 for locations. Upstream (PSG1) and downstream (PSG4) flow measurements will be compared to determine the volume of water gained (or lost) in this stretch of the creek. Possible methods of flow measurement being considered include installing v-notch weirs (preferable method) or direct measurements using flow meters. Groundwater flow nets will be constructed to assess the creek/groundwater interaction.

Soil/Sediment Evaluation. A soil/sediment evaluation will be conducted to assess the potential for contaminated surface soils and/or sediments. The investigation will consist of an inspection of the Site, (including Sequoit Creek), and a hydrologic evaluation of the creek. Also refer to Phase 1 Source Characterization, on-Site Surficial Soil and Sediment Sampling.

A Site inspection will be performed to assess the potential for soil contamination. Soil sampling locations will be identified based on the presence of leachate seeps, discolored soils and other visual observations. Possible sediment sampling locations will be identified based on the Sequoit Creek inspection. Proposed sampling locations will be presented to U.S. EPA prior to sampling.

Air Evaluation. An air evaluation will be conducted. Existing meteorological data will be collected to determine regional wind direction, windspeed, temperature, and precipitation. The potential for air contamination will be assessed based on this information and landfill gas sampling conducted under Source Characterization.

Human Population Evaluation. Information will be collected to identify, enumerate, and characterize human populations which could be exposed if contaminants were released from the Site. For a potentially exposed population, information will be collected on population size and location. The identification of these populations will be linked with the potential contaminants of concern (i.e., those that are mutagenic, teratogenic, etc.) to identify potential risk. Census and other survey data may be used to identify and describe the population exposed to various contaminated media. Information may also be available from USGS maps land use plans, zoning maps and regional planning authorities. Copies of water supply logs within a two mile proximity to the Site will be submitted, if available.

Ecological Evaluation

An ecological assessment will be conducted as described in the U.S. EPA "Region V Scope of Work for Ecological Assessments" (included in Appendix I) which describes the following eight tasks:

- Task 1 - Characterize Site based on existing data and limited field work
- Task 2 - Prepare preliminary ecological assessment
- Task 3 - Prepared detailed Work Plan for further Site investigation
- Task 4 - Conduct Site investigation
- Task 5 - Revise Work Plan, conduct additional investigation
- Task 6 - Prepare summary of biological and chemical data
- Task 7 - Prepare draft Ecological Assessment Report
- Task 8 - Submit final Ecological Assessment Report

At a minimum, Tasks 1, 2, 7 and 8 will be performed. The need to conduct Tasks 3 through 6 will be determined based on the results of Task 2.

Task 1 field work will consist of sediment sampling in on-Site wetland areas (see Section 4.4.3, On-Site Surficial Soil and Sediment Sampling) and sampling of Sequoit Creek (see Section 4.4.3, Phase 1-Potential Migration Pathway/Contaminant Characterization).

Phase 1 - Source Characterization.

Source characterization will be conducted to assess the potential for the landfill to affect environmental media. Source characterization activities will include:

- Landfill cap evaluation
- Leachate collection system effectiveness
- On-Site surficial soil and sediment sampling
- Leachate sampling
- Landfill gas sampling
- Evaluation of off-site contaminant sources
- Natural gamma logging
- Landfill borings
- Leachate piezometer installation
- Landfill gas probe installation.

Possible Phase 2 source characterization may include installation of leachate extraction wells and gas extraction wells and performing leachate and gas pump tests. In addition, off-site gas monitoring probes may be necessary if the potential for off-site migration of landfill gas is identified.

Landfill Cap Evaluation. A landfill cap evaluation will be conducted to evaluate the effectiveness of the existing cap to minimize infiltration of precipitation.. The landfill cap evaluation will provide data which will be used to perform percolation analysis. Approximately 10 test pits will be performed. Samples of the cap will be collected and analyzed for grain size, Atterberg Limits, natural moisture content, in-place density, and clay mineralogy (x-ray diffraction). Moisture/density curves will be constructed to assess the level of compaction. In-situ permeability tests will be conducted using double ring infiltrometers or Boutwell permeameters.

Test pits will be excavated using a backhoe. The advantage of using test pits rather than borings is that field staff can observe the structure of the cap. Field observations will include the density and species of cover vegetation, root penetration, and evidence of inhomogeneities in the cap. Test pit profiles will be recorded on logs. Waste samples will not be collected.

Leachate Collection System Effectiveness. The leachate collection system effectiveness will be evaluated by pumping from the leachate collection system and monitoring leachate head levels in existing leachate piezometers at a minimum, and gas well flares, if possible. The objective of the evaluation is to assess the response of leachate head levels to pumping and evaluate the need for enhancement of the leachate collection system. In addition, the leachate volume present at the Site will be estimated based on leachate head level measurements, in place refuse volume, base grade elevations, understanding of intermediate cover layers and estimates of refuse porosity.

On-Site Surficial Soil and Sediment Sampling. On-site surficial soils and sediments will be collected in likely soil/sediment deposition areas. Identification and field examination of potential surface water run-off routes and on-Site depositional areas will be performed. One sample from each identified depositional area will be collected. It is expected that a maximum of five samples will be collected. Samples will be analyzed for TCL/TAL parameters, total organic carbon (TOC), and geotechnical index parameters (grain size, Atterberg Limits, natural moisture). Locations will be selected based on a site inspections.

Leachate Piezometer Installation. Four additional leachate piezometers will be installed in the "new" landfill and nine leachate piezometers will be installed in the "old" site. These piezometers will be monitored to assess leachate collection system effectiveness and to collect leachate quality data. In place refuse volumes will be estimated based on the results of the refuse borings. The borings for LP9 through LP13 will be extended to determine subsurface conditions beneath the southern portion of the "old" landfill.

Landfill Gas Probe Installation. Multi-stage landfill gas probes will be installed in the same borehole as each new leachate piezometer (total of 13 new multi-stage gas probes). In addition, five perimeter gas probes (GP1 through GP5) will be installed outside of the landfill area on-Site. Landfill gas monitoring will consist of monitoring the percent methane, oxygen, and carbon dioxide, and VOCs present in each multilevel probe. The monitoring will be conducted using field instrumentation to be described in the QAPP.

Downhole Gamma Logging. Downhole natural gamma logging of existing leachate piezometers, if possible, and new piezometers will be conducted to assess landfill structure (i.e., presence of intermediate clay cover layers). The presence of intermediate cover layers (particularly clay) may substantially effect moisture routing within the landfill and leachate collection efficiency. In addition, neutron and gamma-gamma logging will be conducted to assess moisture content and density/porosity, respectively. Logging of existing leachate piezometers will depend on their current physical condition (i.e., kinked or obstructed piezometers will not be logged).

Leachate Sampling. Approximately five leachate samples will be collected from the Site and analyzed to chemically characterize leachate composition. Leachate samples will be collected from the following five locations: Manhole MHE and leachate piezometers LP1, LP6, LP8, and LP11. Samples will be analyzed for TCL/TAL parameters and the following indicator parameters:

- Field pH
- Field Specific Conductance
- Chloride
- Eh
- Dissolved Oxygen
- Sulfate
- Alkalinity

- Total Hardness
- Nitrate Nitrogen
- Nitrite Nitrogen
- Ammonia Nitrogen
- Total Organic Carbon
- Total Dissolved Solids.

Landfill Gas Sampling. Approximately five samples of landfill gas will be collected from landfill gas probes associated with leachate piezometers and/or gas well flares. Landfill gas samples will be collected from landfill gas probes at the following leachate piezometers: LP1, LP6, LP7, LP8, and LP11. These locations have been chosen to provide adequate areal coverage of the Site. Samples will be analyzed for VOCs to chemically characterize landfill gas. Methane, carbon dioxide and oxygen concentrations will also be measured at these locations. These data will be used to assess the potential for contamination of air.

Landfill Borings. Approximately five landfill borings (B1 through B5; see Drawing 60953-F10) will be drilled along the southern perimeter of the "old" landfill to determine subsurface conditions and evaluate the feasibility of constructing a barrier along the perimeter of the landfill to contain leachate.

Evaluation of Off-Site Sources. Potential off-site contaminant sources will be identified, if possible, during the investigation. Several potential off-site sources have been identified in Section 3.1.3. and in Section 3.6. Further review of aerial photographs and available site history information and site observations will be conducted. Specific field investigation activities (soil borings, monitoring wells, sampling, etc.) have not been proposed.

Phase 1 - Potential Migration Pathway/Contaminant Characterization

The objective of this program is to evaluate the magnitude and extent of contamination, if any. Additional monitoring points may be added to accomplish this objective. Each potential migration pathway will be evaluated including:

- Groundwater, including private and municipal water supply wells
- Surface water
- Sediments/soils
- Air.

Groundwater. In Phase 1, groundwater monitoring wells will be sampled and analyzed for U.S. EPA TCL/TAL parameters and water quality indicator parameters to be specified in the QAPP. In Phase 2, if required, the groundwater sampling parameter list will be reduced based on leachate and Round 1 groundwater analysis. The following monitoring wells will be sampled:

- US1S and 1D
- US4S and 4D
- US6S, 6I and 6D
- G11S and 11D
- W5S
- US3S, 3I, and 3D
- W4S
- W6S
- W7D

Prior to installation of any new monitoring wells, an inspection of existing monitoring wells will be performed to confirm that each is functional.

Private and Municipal Water Supply Wells. Arrangements will be made to have selected private water supply wells sampled. This activity will be coordinated with the Lake County Health Department. Municipal supply wells 3 and 5 (well 4 decommissioned) will also be sampled. Samples will be analyzed for TCL/TAL parameters.

Surface Water. Surface water samples will be collected at three locations along Sequoit Creek: upstream at sampling location S101, near the bend in the creek at sampling location S201, and at the northwest corner of the Site, at sampling location S301. Samples will be analyzed for TCL/TAL parameters.

Sediments/Soils. Sediment and soil samples will be collected as described under Source Characterization.

Air. Air samples will not be collected during Phase 1. Samples will be collected during Phase 2 if Phase 1 investigation demonstrates air sampling is necessary. The need for ambient air monitoring will be discussed and documented in Tech Memo #1.

4.4.4 Task 4: Site Investigation Analysis

An analysis of data collected during the Site investigation will be conducted so the quality and quantity of data adequately supports the Baseline Risk Assessment and FS.

Should the results of the Site investigation indicate that additional data collection or performance assessments are required to screen remedial alternatives, a supplemental Work Plan will be prepared and submitted for U.S. EPA and IEPA review and approval. The project plans described in Task 2 will also be modified to reflect the additional work requirements.

Provisions will be made for conducting additional Site investigation activities after the completion of the Remedial Alternatives Screening (Task 7). These supplemental investigations are intended to further characterize the potential sources, pathways, and/or contaminants and to satisfy the specific data requirements of the applicable remedial actions being considered. Additional data collection can be proposed at any point of the investigation, if necessary.

Technical Memorandum No. 1 will be prepared following this task. The format of this technical memorandum will reflect the draft RI Report format discussed later.

4.4.5 Task 5: Baseline Risk Assessment

The Baseline Risk Assessment may be performed by the U.S. EPA or WMII or their consultant. The overall objective of the RI/FS process is to arrive at Site remedies which mitigate threats to human health and the environmental posed by Site contamination, if any. The Baseline Risk Assessment is an essential component of the evaluation of remedial options. By assuming no further remedial activities take place at the Site, risks identified in the Baseline Risk Assessment provide a basis for comparing the efficacy of each alternative in reducing the Site risks.

General Description. The Baseline Risk Assessment is performed concurrently with the RI/FS and begins at the project scoping stage with identification of potential exposure pathways and determination of the appropriate types and quantities of data necessary for risk assessment. In subsequent steps, characteristics of potentially exposed populations are determined and estimates of contaminant intake are derived. The exposure information is then integrated with information on the toxicology of contaminants, to arrive at an estimate of risk. Because the depth of scientific information pertaining to the effects of chemicals on human health is much greater than for the effects of chemicals on the natural environment, the Baseline Risk Assessment generally emphasizes the quantitative evaluation of human health impacts. Evaluation of the environmental impacts of Site contamination, if any, is usually less detailed and more qualitative in scope.

The Baseline Risk Assessment includes evaluation of risks as they presently exist, assuming current land use conditions prevail at the Site, as well as an evaluation of potential future risks by assuming plausible future land use changes at the Site.

The risk assessment process is organized into the following components:

- Human Health Evaluation
  - Contaminants of potential concern
  - Exposure Assessment
  - Toxicity Assessment
  - Risk Characterization

- Environmental Evaluation.

These components will be discussed in detail in the Baseline Risk Assessment Plan which will be included with Task 2: RI/FS Project Plans.

Preparation of the BRA by WMII will be preceeded by the preparation and submittal; and U.S. EPA review of and comments on a BRA Technical Work Plan (BRA-TWP). The BRA-TWP will specify the general methodologies, procedures, and assumptions to be used in identifying the chemicals of potential concern, exposure pathways, ingestion/adsorption rates, and in estimating human and ecological risk. Comments from the U.S. EPA on the BRA-TWP will be incorporated into the ERA. The BRA-TWP will be submitted to the U.S. EPA as Tech Memo #2.

The draft BRA Report will be submitted to the U.S. EPA and IEPA concurrently with the draft RI Report.

4.4.6 Task 6: Treatability Studies

If necessary, treatability studies may be performed to determine the applicability of selected remedial technologies to Site specific conditions. These may include treatability and cover studies, aquifer testing, and/or material compatibility testing. Treatability testing of waste from the "old" landfill and leachate from both the "old" and "new" landfill will likely be conducted. These studies may be conducted at any stage of the RI/FS. The factors which determine the point at which these studies are initiated include length of time to complete, requisite site-specific data requirements and logistical constraints. Plans for these studies will be incorporated in the initial Sampling and Analysis Plan (SAP) or supplements to the SAP. If required, supplements to the appropriate plans (i.e., FSP, QAPP) will be prepared and submitted to the U.S. EPA and IEPA for review and approval, prior to initiation of this task. The results of the treatability studies will be incorporated into the final RI Report.

4.4.7 Task 7: Reports

Monthly Progress Reports. Progress reports will be prepared and submitted to the U.S. EPA and IEPA by the seventh business day each month. Each report will summarize the technical progress of the RI/FS. The progress reports will include the following information:

- Validated sampling and testing results
- A description of activities completed during the past month, as well as actions which are scheduled for the next month
- Target and actual completion dates for each activity including explanations for deviations from the approved schedule
- Changes in key personnel
- Problems encountered and how they were resolved
- Anticipated problems and recommended solutions.

Technical Memoranda. The results of the Site Investigation Analysis will be submitted to the U.S. EPA and IEPA in Tech Memo #1. The Respondent's response to any review comments provided by the U.S. EPA and IEPA will be in the form of letters submitted by the Respondent's Project Coordinator. Any U.S. EPA requested revisions to Tech Memo #1 will be incorporated into the draft or final RI reports as appropriate. The approach to be followed in the preparation of the Baseline Risk Assessment (BRA) for the H.O.D. Landfill Site will be presented in the BRA-TWP (Tech Memo #2). This document will be submitted to the U.S. EPA for review and comment. Any comments provided by the U.S. EPA will be addressed in a letter by the respondent's Project Coordinator and incorporated into the draft BRA. Technical memoranda developed in support of the RI will include the following:

- No. 1: Physical and Source Characterization and Contaminant and Migration Pathways Characterization Results
- No. 2: BRA-TWP

Draft RI Report. A draft RI Report summarizing the RI activities will be prepared and submitted to U.S. EPA. The format of the RI Report will generally follow the October 1988 RI/FS guidance document. The report will characterize the Site and summarize the data collected and conclusions from the preceding tasks. The report will be submitted in draft form for review and comment. The RI report will not be considered final until Site characterization activities are complete for supporting remedial alternatives screening activities and a letter of approval is issued by the U.S. EPA Remedial Project Manager. A meeting may be scheduled with the U.S. EPA and IEPA to discuss comments on the draft RI Report. The U.S. EPA will submit the draft RI Report to ATSDR for health assessment.

4.4.8 Tasks 8 and 15: Community Relations Support and Programs

The Respondents will cooperate with the U.S. EPA in providing RI/FS information to the public. The responsible parties will, at the request of the U.S. EPA, participate in the preparation of information distributed to the public, such as fact sheets, and in public meetings that may be held or sponsored by the U.S. EPA to describe activities at, or concerning, the Site, including the findings of the RI/FS. In light of the pending litigation involving this Site, the U.S. EPA shall make reasonable efforts to provide the Respondents an opportunity to review and comment on all public information releases prior to dissemination to the public so long as such commentary does not unreasonably delay such releases.

Community relations support will be consistent with Superfund community relations policy, as stated in the "Guidance for Implementing the Superfund Program" and Community Relations in Superfund - a Handbook.

4.4.9 Task 9: Conduct Interim Actions

The TS (Task 1) included the review of probable RD/RA activities in planning the Site characterization portion of the RI. In some cases, the RA alternatives may be very limited and require minimal Site characterization in order to select a remedy. If appropriate, RA activities will be categorized as Operable Units to the extent possible and these activities will be evaluated for possible streamlining of the FS process, thereby accelerating remedial action.

4.4.10 Task 10: Development of Remedial Action Alternatives

The purpose of this task is to develop a range of remedial alternatives for the Site. This task constitutes the first stage of the FS and is comprised of interrelated subtasks. The subtasks described below may be viewed as steps that involve making successively more specific definitions of potential remedial activities.

Develop Remedial Action Objectives. Site-specific objectives for remedial action established during the RI will be reviewed. The description of the current situation, information gathered during the RI, Section 300.68 of the NCP, (or as amended), U.S. EPA interim guidance, and requirements of other applicable U.S. EPA, Federal, and Illinois environmental standards, guidance, and advisories will be considered in developing these objectives.

These objectives consist of media-specific or Operable Unit-specific goals for protecting human health and environment. They will specify: the potential contaminant(s) of concern, potential exposure route(s), and potential receptor(s), and an acceptable potential contaminant level or range of levels for each exposure route.

Acceptable exposure levels for human health will be determined on the basis of risk factors and chemical-specific ARARs. Contaminant levels in each media will be compared with these acceptable levels, which will be determined on the basis of an evaluation of the following factors:

- For carcinogens, whether the chemical-specific ARARs are within the risk range of 10^{-4} to 10^{-6} (with 10^{-6} as the point of departure) and whether achievement of each chemical-specific ARAR will sufficiently reduce the total risk from exposure to multiple chemicals

- For non-carcinogens, whether the chemical-specific ARAR is sufficiently protective if multiple chemicals are present at the Site

- Whether environmental effects (in addition to human health effects) are adequately addressed by the ARARs

- Whether the ARARs adequately address all significant pathways of human exposure identified in the baseline risk assessment. For example, if exposure from the ingestion of fish and drinking water are both significant potential pathways of exposure, application of an ARAR that is based only on drinking water ingestion (e.g., MCLs) may not be adequately protective.

If an ARAR is determined to be protective, it will be used to establish the acceptable exposure level. In the situation that the ARAR is not protective (i.e., an existing standard presents a risk greater than 10^{-4}), or an ARAR does not exist for the specific chemical or pathway of concern, or multiple contaminants may be posing cumulative or compounding risk, acceptable exposure levels will be identified through the risk assessment process.

Develop General Response Actions. General response actions describing those actions that will satisfy the remedial action objectives will be developed. These may include no action, treatment, excavation, containment, extraction, disposal, or institutional actions, or a combination of these.

Identify Volumes or Areas of Media. An initial determination will be made of areas or volumes of media to which general response actions might be applied. This will be done for each medium of interest at the Site.

Identify and Screen Remedial Technologies and Process Options. Applicable technology types and process options will be screened by evaluating the options with respect to technical implementability. This screening is accomplished by using readily available information from the RI to screen out technologies and process options that cannot be effectively implemented.

Evaluate Process Options. The technology processes considered to be implementable are evaluated in greater detail before selecting one or two processes to represent each technology type. Process options are evaluated using effectiveness, implementability, and cost criteria.

Assemble Alternatives. Alternatives are assembled using a combination of general response actions and the process options chosen to represent the various technology types for each medium or operable unit, for the Site as a whole. These may include:

- Treatment alternatives for source control that eliminate or minimize the need for long-term management (including monitoring)

- Alternatives involving treatment as a principal element to reduce the toxicity, mobility, or volume of waste

- An alternative that involves containment of waste with little or no treatment but provides protection of human health and the environment, primarily by preventing exposure or reducing the mobility of the te

- No Action alternative.

Alternatives Array Document (AAD). To obtain ARARs and to-be-considered (TBC) materials from the U.S. EPA and the IEPA, a formal request providing a description of alternatives (including the extent of remediation contaminant levels to be addressed, and method of treatment) will be prepared. Tech Memo #3 will be prepared and submitted to the U.S. EPA and IEPA detailing evaluations conducted in Task 10, along with the request for a notification of the ARARs and TBC materials.

4.4.11 Task 11: Screening of Alternatives
This task will narrow the list of potential alternatives that will be evaluated in detail and is comprised of the steps discussed in the following sections.

Alternatives will be further defined to form a basis for evaluation and comparing them prior to their screening. Sufficient quantitative information to allow differentiation among alternatives with respect to effectiveness, implementability, and cost is required. Parameters that require additional refinement include the extent or volume of contaminated material and the size of major technology and process options. The following information will be developed, as appropriate, for the various technology processes used in an alternative:

- Size and configuration of on-Site extraction and treatment systems or containment structures
- Time frame in which treatment, containment, or removal goals can be achieved
- Rates or flows of treatment
- Spatial requirements for constructing treatment or technologies for staging construction materials or excavated soil or waste
- Distances for disposal technologies
- Required permits and imposed limitations.

Screening Evaluation. Defined alternatives are evaluated against short- and long term aspects of three broad criteria: effectiveness, implementability, and cost. These are described as follows:

- Effectiveness: Alternatives will be evaluated to determine whether they adequately protect human health and the environment; attain Federal and Illinois ARARs or other applicable criteria, advisories, or guidance; significantly and permanently reduce the toxicity, mobility or volume of the hazardous constituents; are technically reliable; and are effective in other aspects. The consideration of reliability will include the potential for failure and the need to replace the remedy.

- Implementability: Alternatives will be evaluated as to the technical feasibility and availability of the technologies that each alternative would employ; the technical and institutional ability to monitor, maintain, and replace technologies over time; and the administrative feasibility of implementing the alternative.

- Cost: The cost of construction and long-term costs to operate and maintain the alternative will be evaluated. This evaluation will be based on conceptual costing information and not a detailed cost analysis. At this stage of the FS, cost will be used as a factor when comparing alternatives that provide similar results, but will not be a consideration at the screening stage when comparing treatment and non-treatment alternatives that provide similar results.

Alternative Screening. Alternatives with the most favorable composite evaluation of all factors are retained for further consideration during detailed analysis. Alternatives selected will preserve the range of treatment and containment technologies initially developed plus the no action alternative. Results of the alternatives screening will be incorporated into the draft FS report.

The need for treatability and supplemental remedial investigations will be evaluated and, if required, initiated following discussions with the U.S. EPA.

4.4.12 Task 12: Treatability and Supplemental Remedial Investigations

Data requirements not already available through the RI that are specific to the remedial alternatives identified for detailed analysis in Task 11 will be identified. These additional data needs may involve the collection of additional Site characterization data (through a supplemental investigation) or treatability studies to better evaluate technology performance.

Determination of Data Requirements. Additional data needs will be identified by conducting a more extensive literature survey than was originally conducted when potential technologies were initially being identified. The objectives of this literature survey will be to:

- Determine whether the performance of technologies under consideration have been sufficiently documented on similar wastes considering the scale and the number of times the technologies have been used
- Gather information on relative costs, applicability, removal efficiencies, O&M requirements, and implementability of the candidate technologies
- Determine testing requirements for bench or pilot studies, if required.

Treatability Testing. Treatability testing, if required, will be used to more fully evaluate a specific technology, including performance, determining process sizing, and estimating costs in sufficient detail to support the remedy selection process. It is not meant to be used solely to develop detailed design or operating parameters that are more appropriately developed during the remedial design phase. Bench-scale or pilot-scale techniques may be utilized but, in general, treatability studies will include the following steps:

- Preparation of a Work Plan (or modifying the existing Work Plan) for the bench or pilot studies for U.S. EPA approval in consultation with the IEPA
- Performing field sampling, and/or bench testing, and/or pilot testing
- Evaluating data from field studies, and/or bench testing, and/or pilot testing
- Preparing a brief report documenting the results of the testing.

Treatability testing information will be directly integrated, as appropriate, into the detailed analysis of alternatives under Task 13.

4.4.13 Task 13: Remedial Alternative Evaluations

Section 121(b)(1)(A-G) of CERCLA outlines general rules for cleanup actions and establishes the SARA statutory preference for permanent remedies, and for treatment and/or resource recovery technologies that reduce toxicity, mobility or volume of hazardous substances, pollutants and contaminants. Further, it directs that the long-term effectiveness of alternatives be specifically addressed and that at a minimum the following be considered in assessing alternatives:

- Long-term uncertainties associated with land disposal
- Goals, objectives, and requirements of the Solid Waste Disposal Act
- Persistence, toxicity, mobility and propensity of hazardous substances and their constituents to bioaccumulate
- Short and long term potential for adverse health effects from human exposure
- Long-term maintenance costs
- Potential for future remedial action costs if the alternative were to fail
- Potential threat to human health and the environment associated with excavation, transportation and redisposal, or containment.

The U.S. EPA has developed nine evaluation criteria. Consideration of the criteria is intended to satisfy the statutory requirements; i.e., the points discussed above, and to enable the decision maker to compare alternatives and select a remedy which will:

- Be protective of human health and the environment
- Attain applicable or relevant and appropriate requirements (ARARs), or provide grounds for invoking a waiver

- Be cost effective

- Use permanent solutions and alternative treatment technologies to the maximum extent practicable

- Satisfy the preference for treatment that reduces toxicity, mobility or volume as a principal element (or provide an explanation for why it does not).

The evaluation of alternatives task is basically a three-stage process consisting of the following:

- Detailed development of alternatives

- Detailed analysis of alternatives

- Comparison of alternatives.

Detailed Development of Alternatives. Each alternative will be defined in sufficient detail to facilitate subsequent evaluation and comparison. Typically, this activity may involve modification of alternatives based on ARARs, refinement of quantity estimates, technology changes, or Site areas to be addressed. Prior to detailed definition, the final conceptual alternatives will be agreed on by the Respondents and the U.S. EPA, in consultation with the IEPA.

Detailed Analysis of Alternatives. A detailed analysis of alternatives will be conducted which will consist of an individual analysis of each alternative against a set of evaluation criteria and a comparative analysis of all options to assess relative performance in terms of the evaluation criteria. The nine evaluation criteria and their hierarchical order are as follows:

Threshold Factors

- Protective of human health and environment

- Compliance with ARARs

Balancing Factors

- Long-term effectiveness and permanence
- Reduction of toxicity, mobility or volume (TMV) through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying Factors

- State acceptance (support agency)
- Community acceptance

In evaluating the alternatives, the threshold factors must be satisfied prior to consideration of the balancing factors. The balancing factors are only applied to those alternatives that meet the threshold factors criteria. The modifying factors are applied to the alternatives subsequent to the balancing factor evaluations.

The evaluation criteria are as follows:

- Overall Protection of Human Health and the Environment addresses whether or not a remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced or controlled through treatment, engineering controls, or institutional controls.
- Compliance with ARARs addresses whether or not a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and Illinois environmental statutes and/or provide grounds for invoking a waiver.
- Long-Term Effectiveness and Permanence refers to the ability of a remedy to maintain reliable protection of human health the the environment over time once cleanup goals have been met.

- Reduction of Toxicity, Mobility or Volume through Treatment is the anticipated performance of the treatment technologies a remedy may employ.

- Short-Term Effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

- Implementability is the technical and administrative feasibility of a remedy, including the availability of materials and services needed to implement a particular option.

- Cost includes estimated capital and operation and maintenance costs, and net present worth costs.

- State Acceptance (Support Agency) addresses the technical or administrative issues and concerns the support agency may have regarding each alternative.

- Community Acceptance addresses the issues and concerns the public may have to each of the alternatives.

The individual analysis will include a technical description of each alternative that outlines the waste management strategy involved and identifies the key ARARs associated with each alternative, and a discussion that profiles the performance of that alternative with respect to each of the evaluation criteria. A table summarizing the results of this analysis will be prepared. Once the individual analysis is complete, the alternatives will be compared and contrasted to one another with respect to each of the evaluation criteria.

In selecting a preferred alternative, the U.S. EPA will only consider selecting an alternative that does not meet the Federal or State Public Health or environmental ARARs when:

- The alternative is an interim remedy and will become part of a more comprehensive final remedy that will meet the Federal and State ARARs.

- Compliance with the ARAR will result in a greater risk to human health and the environment than the alternative options.

- Compliance with the requirements is technically impractical.
- The alternative will attain a standard of performance that is equivalent to that required under the otherwise applicable standard, requirement, or limitation through the use of another method or approach.
- The State has not consistently applied or demonstrated the intent to consistently apply the requirement at other similar facilities across the state.

Comparison of Alternatives
After each alternative has been individually assessed against each of the nine criteria, a comparative analysis will be conducted. The purpose of this analysis is to compare the relative performance of each alternative with respect to each specific evaluation criterion. The narrative discussion will describe the strengths and weaknesses of the alternatives relative to one another with respect to each criterion, and how reasonable variations of key uncertainties could change the expectations of their relative performance. If innovative technologies are being considered, their potential advantages in cost or performance and the degree of uncertainty in their expected performance (as compared with more demonstrated technologies) will also be discussed. A summary table will be prepared highlighting the assessment of each alternative with respect to each of the nine criteria.

Findings of the detailed analysis of alternatives will be presented in the draft FS report.

4.4.14 Task 14: Feasibility Study Report
The results of Task 10: Development of Remedial Action Alternatives will be submitted to the U.S. EPA and IEPA in Tech Memo #3. This memorandum will be submitted in draft form only. Responses to review comments provided by the U.S. EPA in conjunction with the IEPA, will be provided in letters submitted by the Respondent's Project Coordinator. Any revisions will be provided in the draft or final RI/FS reports as appropriate. The information developed under Tasks 11, 12, and 13 will be integrated directly into the draft FS report.

The draft report will be submitted to the U.S. EPA and IEPA for review and comment. A meeting will be scheduled to discuss U.S. EPA comments, if any, prior to preparation of the final draft report. The FS report will not be considered final until a letter of approval is issued by the U.S. EPA Project Manager. The approved public comment FS report will be placed by the U.S. EPA in Public repositories for public review and comment as per the Community Relations Plan for this Site. The report will completely document the FS effort. The format for the FS report will generally follow the October 1988 RI/FS guidance document.

4.5 Request for ARAR Notification

This section has been prepared as a formal request of federal and state agencies to elicit the identification of applicable or relevant and appropriate regulations (ARARs) and to-be-considered (TBC) requirements for the performance of the RI/FS proposed herein at the H.O.D. Landfill. This request applies to ARARs and TBCs that would address RI/FS activities such as monitoring well construction, investigative waste management, laboratory studies, etc.

A formal request to the U.S. EPA and IEPA will be made by WMII for identification of ARARs, and TBC materials applicable to the proposed remedial alternatives. This formal request will be supported by a Technical Memorandum (or Alternatives Array Document) that will provide, in addition to a discussion of on-site history, specific information on:

- Site location relative to such features as the proximity historical/scenic landmarks, and environmental habitat, or the use of land areas for treatment/disposal - leading to identification of location specific ARARs
- Chemicals of concern - leading to identification of chemical specific ARARs
- Remedial action alternatives that may be implementable at the Site - leading to identification of action specific ARARS.

This request for ARARs will follow the identification of remedial alternatives task in the FS.

4.6 Schedule

The anticipated schedule for performing RI/FS activities is presented on Figure 10.

4.7 Project Management

Project management encompasses those activities and responsibilities of key individuals that will be responsible for the implementation of the RI/FS activities in accordance with the governing documents and regulatory requirements; primarily the AOC, the Work Plan and other planning documents (following approval by the U.S. EPA and IEPA), and other guidance documents such as the U.S. EPA, March 1988, "Guidance For Conducting Remedial Investigations and Feasibility Studies Under CERCLA", and national policy programs such as the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). The key individuals identified below will be responsible for seeing that communications are open and frequent, that key decisions potentially impacting the scope, direction, and/or schedule of the project are made in an expeditious manner, and that potential problems are identified and resolved in a cooperative environment so that the project can proceed toward the overall objective of identifying reasonable and environmentally sound remedial alternatives, through the identification and quantification of the potential environmental impacts associated with the Site.

4.7.1 Lead Contacts.

Key individuals associated with implementing the RI/FS for the Site in accordance with the AOC are:

Waste Management of Illinois, Inc. - WMII

Mr. March E. Smith
Remedial Project Manager
Two Westbrook Corporate Center
Suite 1000
P.O. Box 7070
Westchester, Illinois 60154

phone (708) 409-0700
fax (708) 409-0733

Warzyn Inc. - Consultant to WMII

Gary E. Parker, P.E.
Senior Manager
2100 Corporate Drive
Addison, Illinois 60101

phone (708) 691-5138
fax (708) 691-5133

U.S. Environmental Protection Agency Region V - Lead Agency

Mr. Fred Micke
Remedial Project Manager
H.O.D. Landfill Site
Region V (5HS-11)
230 Dearborn Street
Chicago, Illinois 60604

phone (312) 886-5123
fax (312) 886-4071

Illinois Environmental Protection Agency - Concurring Agency

Mr. Paul Takacs
State Project Manager
Federal Site Management Unit
Division of Land Pollution
2200 Churchill Road
Springfield, Illinois 62706

phone (217) 524-4827
fax (217) 524-4193

Key personnel for the H.O.D. Landfill RI/FS are shown on Figure 11.

4.7.2 Project Communications

Both written and oral communications will be used to see that project information is conveyed to appropriate individuals in a timely and cost effective manner. Draft and final versions of major deliverables identified in the AOC, the Work Plan, and other planning documents, will serve as the documentation of existing Site conditions, findings of Site investigation activities, and identification of potential and viable remedial actions and options. The Monthly Progress Report will document the status of project activities relative to the U.S. EPA/IEPA approved planning documents and schedule.

Frequent telephone communications, involving all appropriate parties, will serve to keep project participants informed of ongoing and changing project status, as well as early identification of potential project difficulties and discussion of alternative corrective actions that may be implemented.

4.7.3 Progress

Project status/progress will be documented and formally provided to the U.S. EPA and the IEPA through the Monthly Progress Report. The Monthly Progress Report will be provided to the U.S. EPA and IEPA by the seventh business day of each month throughout the duration of the project, as required by Section IX of the AOC. The Monthly Progress Report will follow a consistent format that as a minimum addresses the five key areas of:

> Progress - action taken during the reporting period toward achieving compliance with the Consent Order.
>
> Completed Sampling/Analytical Results - status of sampling completed and any validated analytical results received during the reporting period.
>
> Plans- activities scheduled to be accomplished during the next reporting period.
>
> Problems/Corrective Actions - discussion of any difficulties encountered in carrying out the planned work in accordance with approved planning documents and the AOC, and any actions taken or to be taken to rectify those difficulties.
>
> Schedule - comparison of target and actual delivery dates for deliverables and key milestones, and, if required, discussion of potential impact on the overall schedule.

4.7.4. Problem Identification/Resolution

The early identification and expeditious resolution of potential difficulties that may impact project schedule will be critical to successfully completing the RI/FS. Potential problems may range the full spectrum from field decisions such as selecting alternate sampling locations because of unanticipated subsurface or Site conditions, to the unavailability of a specialized laboratory to conduct specific treatability studies. Frequent communications and a clearly defined scope of activities to be conducted under the RI/FS will minimize, but not eliminate, the potential for encountering such difficulties. However, once such difficulties are encountered they will be expeditiously addressed, alternative actions will be identified and documented, and the appropriate action will be selected and agreed upon by involved parties. For this project, when difficulties that may impact the project schedule are encountered, the following actions will be initiated:

- Key personnel will be contacted by telephone and advised of the nature and scope of the difficulty. Depending upon the magnitude and immediacy of the difficulty and the potential impact on the overall project schedule, a conference call may be scheduled to review the difficulty, identify and solicit a range of corrective actions that may be implemented, and select a remedy to rectify the difficulty.

- A memorandum describing the difficulty encountered, its potential impact on schedule, and, if available, corrective actions that may be implemented, will be prepared and submitted to key individuals as follow-up to the telephone notification.

- A follow-up memorandum documenting the potential corrective actions available and action ultimately implemented will be prepared and submitted. Any impact of the project schedule will also be documented.

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SECTION 5
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Table 1

Summary of Municipal Well Information
H.O.D. Landfill

Well No.	Date	Driller	Ground Elevation	Total Depth	Screened Interval	Formation
1	1907	Charles Thorne	780	216	207-216	Sand and Gravel
2	1906/ 1949	CL Wertz	780	226/231.5*	210-231.5	Sand and Gravel
3	1953	Layne-Western	770	150	120.5-140.5	Sand and Gravel
4	1965	Layne-Western	770	141	109-129	Sand and Gravel
5	1978	Layne-Western	--	131	109-129	Sand and Gravel

* Well was rehabilitated in 1949.

Table 2

Summary of Permitted Special Wastes*
H.O.D. Landfill

Generator	Waste Name	Annual Authorized Volume	Permit Period
Fox Lake Northwestern Region	Digested liquid domestic sludge	520,000 gallons	Through 9/18/86
Round Lake Sanitary District	Secondary digestor sludge	2,000 gallons/day	8/9/77 through 9/84
Village of Antioch	Aerobic digested domestic waste water sludge	200 cubic yards	11/81 through 9/84
Village of Libertyville	Storm sewer sludge and grit	260 cubic yards	8/83 through 7/86
Travenol Labs	Fat emulsion	182,000 gallons	11/81 through 11/84
Waste Management of Wisconsin	Automotive manufacturing sludge	13,728 cubic yards	3/83 through 3/86
Abbott Laboratories	Activated sludge	7,000,000 gallons	3/83 through 3/86
Abbott Laboratories	Ogen products (outdated pharmaceutical product)	5,500 gallons	5/83 through 5/86
Abbott Laboratories	Spent beer concentrate	5,000,000 gallons	3/83 through 3/86
Great Lakes Naval Base	Animal fat	80 cubic yards	3/82 through 1/85
Intermatic	Paint booth waste	2,500 gallons/month	3/75 through 10/79
Spring Grove, Illinois	Waste oils and chlorinated solvents	Uncertain	10/78 through 10/79

Table 2
(Continued)

Generator	Waste Name	Annual Authorized Volume	Permit Period
Pickard Inc., Antioch, Illinois	Water and clay waste	1,200 gallons	11/81 through 12/84
Wells Manufacturing, Woodstock, Illinois	Slag	1,040 cubic yards	8/81 through 8/84
Wells Manufacturing, Woodstock, Illinois	Baghouse dust and grinding sludge	1,248 gallons	11/82 through 12/84
OMC Johnson	Water soluble coolant and oil waste	500,000 gallons	11/81 through 11/84
Morton Chemical Company	AMBT wastewater	200,000 gallons	2/82 through 2/85
Morton Chemical Company	Wastewater latex emulsion	1,500,000 gallons	8/82 through 10/85
Morton Chemical Company	Waste filter cake and latex sludge	100,100 gallons	12/81 through 1/85
Morton Chemical Company	Spent Carbon	9,000 gallons	12/81 through 1/85
Morton Chemical Company	Baghouse dust	8,640 cubic yards	7/83 through 6/85
Quaker Industries	Water soluble oil and stain	10,000 gallons	2/26/80 through 2/26/81
Quaker Industries	Paint, coolants, and paint booth oversprays	90 drums	3/29/77 through 3/29/78

* Based on a review of IEPA permit files, an entry on this table indicates that IEPA approved these waste types and quantities at the Site. Wastes listed on this table may or may not have been actually disposed at the Site.

Table 3

Summary of Expanded Site Inspection Field Activities H.O.D. Landfill

A. Soil Borings/Monitoring Wells Drilled
(See Drawing 60953-F2 for locations)

SB1
SB1A
US1S*
US1D*
US2D*
US3S*
US3D*
US4S*
US4D*
US5D*
US6S*
US6I*
US6D*
US7S*

* Monitoring Well Installed

B. Hydraulic Conductivity Testing

US1S
US1D
US2D
US3S
US3I
US3D
US4S
US4D
US5D
US6S
US6I
US6D
US7S

C. Soil Sampling and Analysis (TCL/TAL)

US1D (Samples S1 - S8)
US3D (Samples S9 - S16)
US2D (Samples S17 - S27)
US4D (Samples S28 - S35)
U5D (Samples S36 - S40)
US6D (Samples S41 - S45)
US7S (Samples S46 - S49)

D. Groundwater Sampling

1. Round 1 (8/10 - 12/87)
(TCL/TAL)

US1S
US1D
US3S
US4S
US4D
US5D
US6S
US6I
US6D
US7S
MW1D
MW2
MW3
MW4S
MW4D

Residential Wells RW1 - RW8

2. Round 2 (4/19/88) (VOCs)

US1S
US1D
US3S
US4S
US4D

3. Round 3 (5/19/88) (VOCs)

US1S
US1D
US6I
US6D
US4D

Table 4

Summary of Soil Borings/Monitoring Wells
H.O.D. Landfill

Boring/Well Number	Date Constructed	Constructed By*	Comments
SC1A - SC4D	February - March 1990	PELA	Sequoit Creek Piezometers in support of litigation
LB1 - LB10	July - October 1989	PELA	13 soil borings performed in support of litigation
PE3, PE3A	September 1989	PELA	2 soil borings in support of litigation
PZ1 - PZ6U	August 1989 - April 1990	PELA	8 temporary piezometers constructed in support of litigation
US1D - US7S	April - June 1987	U.S. EPA	13 monitoring wells for expanded site inspection
SB1, SB1A	April - May 1987	U.S. EPA	2 soil borings
IB1 - IB10	August 1989	Patrick Engineering	Soil borings for Environmental Audit of Sequoit Acres Industrial Park in support of litigation
LB8, PE3, PE3A	September 1989	Patrick Engineering	Soil borings for Environmental Audit of Sequoit Acres Industrial Park in support of litigation
LP1 - LP10	May, 1983	TSC	Leachate piezometers
LP2A, LP3A	September 1984	TSC	Leachate piezometers
G11D, G14D	May 1974	TSC	2 monitoring wells constructed for original site development permit
B1 - B75	June 1989 -- July 1990	TSC	75 shallow borings to verify cover thickness
TSC 1101 - TSC 1210	February 1981	TSC	26 soil borings for supplemental site operations permit

Table 4
(continued)

Boring/Well Number	Date Constructed	Constructed By*	Comments
TSC 201 - TSC 210	December 1981	TSC	10 soil borings
TSC 1001 - TSC 1004	February 1980	TSC	4 soil borings
TSC 1 - TSC 22	May - August 1973	TSC	Soil borings for original site development permit
TSC 23 - TSC 27	May 1974	TSC	Soil borings for original site development permit
GWF1 - GWF14	June 1988	Kellett's Well Boring Inc.	14 Gas Flares
VA5	July 1990	Raimonde Drilling Chicago, IL	1 soil boring by litigation plaintiff

Notes:
*PELA = PE. LaMoreaux and Associates   TSC = Testing Service Corporation

Table 5

Summary of Soil Testing Results
H.O.D. Landfill

		Results of Grain Size Analysis					Hydraulic	
Boring No.	Sample Depth (ft)	Gravel (%)	Sand (%)	Silt (%)		Clay (%)	Conductivity (cm/sec)	Source of Test Results
LB1	13.0 to 17.5	46	44	-	10	-	$6.3x10^{-3}$*	PELA
LB1	20.5 to 25	33	57	-	10	-	$4.7x10^{-4}$*	PELA
LB1	26.5 to 31	52	36	-	12	-	$1.4x10^{-3}$*	PELA
LB2	7.0 to 8.5	38	54	-	8	-	$5.0x10^{-3}$**	PELA
LB2	11.5 to 13	67	27	-	6	-	$4.1x10^{-2}$**	PELA
LB3	5.5 to 7	43	54	-	3	-	$1.2x10^{-2}$**	PELA
LB4	10.0 to 11.5	0	92	-	8	-	$5.0x10^{-3}$**	PELA
LB4A	22.0 to 23.5	57	41	-	2	-	$4.4x10^{-2}$**	PELA
LB4A	38.5 to 40	68	27	-	5	-	$7.3x10^{-2}$**	PELA
LB4A	40.0 to 44.5	75	20	-	5	-	$1.4x10^{-1}$**	PELA
LB4A	54.5 to 56.5	43	54	-	3	-	$1.4x10^{-2}$**	PELA
LB9	8.5 to 11.5	9	72	-	19	-	$7.3x10^{-4}$**	PELA
LB9	14.5 to 19	57	35	-	8	-	$1.5x10^{-2}$*	PELA
LB9	25.0 to 29.5	52	38	-	10	-	$3.8x10^{-4}$*	PELA
LB9	49.0 to 53.5	50	40	-	10	-	$5.9x10^{-3}$**	PELA
LB10	10.0 to 14.5	49	46	-	5	-	$1.3x10^{-3}$*	PELA
LB10	16.0 to 20.5	45	52	-	3	-	$1.3x10^{-3}$*	PELA
LB10	43.0 to 46	47	44	-	9	-	$2.0x10^{-2}$**	PELA
LB10	46.0 to 50.5	84	13	-	3	-	$7.7x10^{-1}$**	PELA
LB2	18.5 to 19.5	0	27	32	-	41	$1.1x10^{-8}$**	PELA
LB2	64.5 to 65.5	0	47	18	-	35	$1.1x10^{-8}$**	PELA
LB3	16.0 to 17.5	1	25	45	-	29	$1.2x10^{-8}$**	PELA
LB4A	68.5 to 70.5	2	43	31	-	24	$1.0x10^{-8}$**	PELA
GW3I	49.5 to 51	0	10	24	-	66	–	U.S. EPA ESI
GW3I	55.0 to 57.5	0	23	24	-	53	$2.3x10^{-8}$	U.S. EPA ESI
GW2D	19.0 to 21.5	0	38	44	-	18	$1.2x10^{-6}$	U.S. EPA ESI
LB10+	56.5 to 58	-	-	-	-	-	$1.1x10^{-6}$*	PELA
LB10+	58.0 to 59.5	-	-	-	-	-	$2.9x10^{-6}$*	PELA
LB10+	59.5 to 61	-	-	-	-	-	$6.9x10^{-7}$*	PELA
LB2	18.5 to 19.5	-	-	-	-	-	$1.1x10^{-8}$*	PELA
LB2	64.5 to 65.5	-	-	-	-	-	$1.1x10^{-8}$*	PELA
LB3	16.0 to 17.5	-	-	-	-	-	$1.2x10^{-8}$*	PELA
LB4A	68.5 to 70.5	-	-	-	-	-	$1.0x10^{-8}$*	PELA
AL384	6.0 (Clay Sample)	-	-	-	-	-	$3.4x10^{-8}$ ($2.7x10^{-8}$)	GeoServices
AL385	5.0 (Clay Sample)	-	-	-	-	-	$1.9x10^{-8}$ ($1.6x10^{-8}$)	GeoServices
AL386	5.5 (Clay Sample)	0	<1	-	99	-	$8.4x10^{-8}$ ($6.0x10^{-8}$)	GeoServices
AL387	10.5 (Clay Sample)	-	-	-	-	-	$9.0x10^{-9}$ ($8.5x10^{-9}$)	GeoServices
AL388	6.5 (Clay Sample)	-	-	-	-	-	$1.6x10^{-8}$ ($1.5x10^{-8}$)	GeoServices
AL389	8.5 (Silty Sand)	-	-	-	-	-	$2.1x10^{-7}$ ($1.5x10^{-7}$)	GeoServices

Notes:

PELA = P.E. LaMoreaux and Associates
ESI = Expanded Site Inspection Report
Where samples have been analyzed for silt plus clay the grain size percentage is shown in the column between silt and clay.
+ Samples were disturbed and dehydrated. Results may not be representative.
* Constant Head Permeability
** Permeability estimated by Hazen's Formula
GeoServices = GeoServices, Boynton Beach, Florida. GeoServices results presented in parentheses were obtained using Site leachate as the permeant. Other GeoServices results were obtained using groundwater obtained from the Site.

V953.01-1AJS/CWB

Table 6

Summary of Slug Test Analysis
Conducted by U.S. EPA FIT*
H.O.D. Landfill

Well No.	Unit Monitored By Well	Conductivity (cm/sec) (Hvorselv Method)	Transmissivity (T) (ft^2/sec) (Cooper Method)	Conductivity (K) (cm/sec) (T = Kb; b = screen length)
US1S	Surficial Sand	4.8×10^{-4}	--	--
US1D	*Deep Sand & Gravel*	--	3.0×10^{-4}	1.8×10^{-3}
US2D	*Deep Sand & Gravel*	--	2.1×10^{-3}	1.3×10^{-2}
US3S	Surficial Sand	2.7×10^{-2}	--	--
US3I	Clay Diamict	7.9×10^{-6}	--	--
US3D	*Deep Sand & Gravel*	--	5.2×10^{-4}	3.1×10^{-3}
US4S	Surficial Sand	5.3×10^{-2}	--	--
US4D	*Deep Sand & Gravel*	--	1.8×10^{-4}	1.1×10^{-3}
US5D	*Deep Sand & Gravel*	--	2.6×10^{-3}	1.6×10^{-2}
US6S	Surficial Sand	7.0×10^{-2}	--	--
US6I	Clay Diamict	8.0×10^{-6}	--	--
US6D	*Deep Sand & Gravel*	--	3.0×10^{-4}	1.8×10^{-3}
US7S	Clay Diamict (Sand Lense)	5.8×10^{-3}	--	--

* Source: Ecology and Environment, Inc. 1989.

Table 7

Summary of VOCs Detected in Village Well 4
H.O.D. Landfill

Compound/Date	2/22/84	4/16/85	2/1/89	3/9/89	3/23/89
Trichloroethene	<1	<1	ND	ND	ND - <1
Vinyl Chloride	--	--	ND-6.7	3.6	0.4-0.8
1,2-Trans-dichloroethene	--	--	ND	ND	ND - <1
1,2-Cis-dichloroethene	--	--	--	--	0.2

Compound/Date	3/24/89	8/22/89	8/23/89	8/24/89	8/28/89
Trichloroethene	ND	ND	<0.2	ND - 0.2	ND-<0.2
Vinyl Chloride	0.8	ND	0.2	ND - 0.2	ND-0.2
1,2-Trans-dichloroethene	ND	--	<0.2	ND - <0.2	ND-<0.2
1,2-Cis-dichloroethene	--	--	--	--	—

Compound/Date	9/13/89	9/14/89	9/27/89	10/26/89	11/9/89
Trichloroethlene	ND-<0.2	ND	ND	ND	ND
Vinyl Chloride	ND-0.2	ND	ND	ND	ND
1,2-Trans-dichloroethene	ND-<0.2	ND	ND	ND	ND
1,2-Cis-dichloroethene	—	—	—	—	-

Compound/Date	12/13/89	5/16/90
Trichloroethene	ND	ND
Vinyl Chloride	ND	ND
1,2-Trans-dichloroethene	ND	ND
1,2-Cis-dichloroethene	--	ND

Notes:
— = Not analyzed
ND = Analyzed, but not detected
Concentrations are reported in ug/L.
Analytical results provided by WMII.

TABLE 8

Data Needs, Collection Activities and Analysis Objectives
H.O.D. Landfill Site
Antioch, Illinois

Data Need	Data Collection Activity	Data Analysis Objective	Level of Effort
PHYSICAL CHARACTERIZATION			
Hydrogeologic Data			
Surficial Sand and deeper sand and gravel	Soil Borings, Monitoring Well/Piezometer Installation, Head Level Measurements,	Confirm Glacial Stratigraphy, Evaluate Flow System, Interaction of Sequit Creek	8 New Borings (W1S, W2D, W3SA/SB, W3D, W4S, W5S, W6S, and W7D) 4 Monitoring Wells (W4S, W5S, W6S, and W7D) and 5 piezometers (W1S, W2D, W3SA/SB (Nested), and W3D)
	Single-Well Conductivity Tests	Hydraulic Conductivity	7 Existing Wells (US1S, US3S, US3D, US4S, US40, US6S, and US6D) Plus 9 new wells/piezometers
	Monitor Village Well Pumping Schedule		
Hydrologic Data			
Sequoit Creek	Flow Monitoring	Characterize Stream Flow, Confirm Groundwater Discharge/Recharge	2 Flow Monitoring Stations 4 Stage Stations
Meteorological Data	Precipitation, Temperature	Hydrologic Analysis of Sequoit Creek, Groundwater/Surface Water Interaction	Nearest NOAA data station, correlate with local Antioch measurements
Soil and Sediment Data	Site inspection Identify potential sampling locations	Assess potential for soil contamination	Field visit
Environmental Data			
Human Receptor Data	Population Characteristics of Public and Private Well Water Supplies	For use in the Baseline Risk Assessment	Field Visits
Ecological Data	Identification of Predominant Local Plant and Resident and Migratory Animal Species	For use in the Baseline Risk Assessment	Field visits for Species Identification (Tasks 1, 2, 7, and 8 of Scope of Work for Ecological Assessments)
Wetlands Delineation	Mapping of Plant/Soil/ Hydrogeologic Community Identifications	Environmental Characterization, Evaluation of limits of Defined Wetlands, Regulatory ARAR's Issues, Constraints on Remedial Actions	Field Visits for Species and Soil/Water Evaluation
Floodplain Delineatory	Survey for Extent of Site Subject to Surface Water Flooding	Environmental characterization, ARAR's, Constraints on Remedial Actions	Field visit to Confirm Record Data

TABLE 8
(Continued)

Data Need	Data Collection Activity	Data Analysis Objective	Level of Effort
SOURCE AREA CHARACTERIZATION			
Refuse Volume	Refuse Borings Geophysical Logging	Use with Existing Data to Estimate Volume, Materials	9 Refuse Borings-Old Landfill 4 Refuse Borings-New Landfill (see note)
Leachate Volume	Leachate Head Wells	Evaluate Leachate Saturated Volume	9 New Leachate Piezometers -Old Landfill 4 New Leachate Piezometers -New Landfill (see note)
Leachate Quality	Leachate Sampling/Analysis	Old and New Landfill Leachate Quality Data	Old and New Landfill: total of 5 Samples from Headwell and Extraction Point
Landfill Contents Characteristics	Solid Waste Sampling/Analysis	Characterization of Fill. Physical Characterization.	5 Samples: Old Landfill 5 Samples: New Landfill
Gas Content and Quality	Gas Probe Installation Gas Sampling/Analysis	Combustible Gas Generation Gas Toxics Evaluation	Multi-level Probes Installed with Leachate Piezometers, Old and New Landfill; 5 samples for analysis; Install 5 Perimeter gas probes
Landfill Borings	Soil Borings Along Southern perimeter "old" landfill	Determine Subsurface Conditions, Evaluate barrier feasibility	5 Piezometer Soil Borings
Leachate Collection System Effectiveness	Leachate System Test Pumping	Hydraulic Characterization of Fill and Collection System	Old Landfill-MHW Test New Landfill-MHE Test Extraction Well Tests
	Test Pits for Soils Classification Vegetative Analysis, Lab and In-situ Permeability	Evaluation of Historic and Long-Term Cover Percolation	10 Test Pits 5 on Old Landfill 5 on New Landfill
On-site Soils and Sediment Quality	Site Inspection Soils Characterization Soils Sampling/Analysis	Evaluation of Surficial Soils and Sediment	5 Soil Samples

Note: Nine refuse borings will be drilled in the "old" landfill and four in the "new" landfill. Each refuse boring will be equipped with a leachate piezometer and multilevel gas probes. The five refuse borings (LP9-LP13) to be drilled in the southern portion of the "old" site will be extended below the base of the refuse to determine subsurface conditions. The Field Sampling Plan will specify procedures to be used to prevent contamination of subwaste materials while drilling. These five borings will be properly backfilled and leachate piezometers installed in the refuse.

TABLE 8
(Continued)

Data Need	Data Collection Activity	Data Analysis Objective	Level of Effort
MIGRATION PATHWAYS AND CONTAMINANT CHARACTERIZATION			
Groundwater	Groundwater Sampling/Analysis	Extent of Impact	Sample 12 existing (US1S & 1D, US4S & 4D, US6S, I & D, US3S, I & D, and G11S & 11D) and 4 New (W4S, W5S, W6S, and W7D) Wells
	Soil Borings	Soil Characteristics, Extent	To be Specified in Tech Memo #1
	Monitoring Well Installation	Access for Water Level Monitoring and Sampling	Install 4 Monitoring Wells (W4S, W5S, W6S, and W7D)
	Water Level Measurements	Flow Field Identification	Bimonthly
Surface Water	Surface Water Sampling/Analysis	Contaminant Migration	3 Samples From Sequoit Creek
Sequoit Creek Sediment	Soils Sampling/Analysis (upstream and downstream)	Contaminant Migration	To be Specified in Tech Memo #1
Air	Air Quality Sampling/Analysis	Contaminant Migration	To be specified in Tech Memo #1

TABLE 8
(Continued)

Data Need	Data Collection Activity	Data Analysis Objective	Level of Effort
CHARACTERIZATION FOR REMEDIAL ACTION ANALYSIS			
Leachate Treatability	Leachate Sampling	For use in Treatability Analysis, Bench Scale Testing	To be Specified in Tech Memo #1
	Surface Water Sampling/Analysis	For Use in Evaluating Treatment Standards Applicable for Discharge	To be Specified in Tech Memo #1 to Sequoit Creek
Gas Treatability	Gas Sampling Analysis	Combustability and Toxics Analysis for Flare Design	To be Specified in Tech Memo #1
Containment Design	Soil Borings	Analysis of Vertical Barrier Installation	To be Specified in Tech Memo #1
	Soil Borings	Evaluation of Potential Soils Borrow Areas	To be Specified in Tech Memo #1

TABLE 9

Data Collection Activities and Data Quality Objectives
H.O.D. Landfill Site
Antioch, Illinois

Data Collection Activity	Parameters	Data Use	Data Quality Objective	Preliminary Selections
PHYSICAL CHARACTERIZATION*				
Soil Boring	Field Boring Logs	Geologic Correlation	RI/FS Field Drilling SOP	Continuous Sampling
Soils Classification	Geologic Characteristics Geotechnical Properties	Interpretation, Correlation Identification, Correlation	RI/FS Soils Classification SOP	
Monitoring Well/Piezometer Installation	Water Level Monitoring	Flow Field Interpretation Contaminant Migration	RI/FS Monitoring Well SOP	PVC Screens/PVC Wells
Location and Elevation Survey	Survey	Interpretation, Remedial Action Design	Field Survey SOP-RI/FS	± 1' horizontal ± 0.01' vertical
Single Well Conductivity Testing	Transmissivity Hydraulic Conductivity	Groundwater Analysis Contaminant Fate and Transport	RI/FS Well Test SOP	
Surface Stream Flow	Discharge Hydrographs	Groundwater/Surface water Interpretation	USDA/USGS/WEI Hydrologic Data SOP	2 Flow Monitoring Stations, Using Wiers
Meteorological Data	Precipitation Temperature	Hydrologic Analysis	NOAA/WEI Met. Data SOP	Daily Rainfall On-Site Max-Min Temperatures
Wetlands Characterization	Wetland Identification, Migratory Species, Rare/ Endangered Species	Characterization	COE/EPA/USFW Criteria, Wetland SOP	Joint Agency Delineation Procedure
Landfill Cover Evaluation	Soils Structure, Geologic/Geotechnical Characteristics, in-situ Permeability	Cover Percolation Estimate	Specific Objectives to be Defined	Permeability tests using Double-Ring Infiltrometers or Boutwell Permeameters.
Water level measurement	Well casing water level	Groundwater flow field interpretation	RI/FS Field Methods SOP	0.01' accuracy

*Data Quality objectives for Physical Characterization will also typically include Level I Analytical Data Quality Objectives.

Table 9
(Continued)

Data Collection Activity	Parameters	Data Use	Data Quality Objective	Preliminary Selections
CHEMICAL CHARACTERIZATION				
Solid Waste Sampling/ Analysis	TCL, TAL, Physical Parameters	Source Characterization Treatment Design	Level IV Data	Composite Samples (except for VOCs)
Leachate Sampling/ Analysis	TCL, TAL, Indicators	Characterization, Treatment Design	Level IV Level III (indicators)	Bailer Sampling
Groundwater Sampling/ Analysis	TCL, TAL, Indicators	Characterization	Level V	Bailer Sampling or Well Wizards
Landfill Gas Sampling/ Analysis	VOCs, Methane, CO_2	Characterization, Treatment Design	Level III	Gas Probe Samples
Surface Water Sampling/ Analysis	TCL, TAL, Indicators	Characterization	Level IV Level III (indicators)	Grab Samples
Soils/Sediment Sampling/Analysis	TCL, TAL, Indicators	Characterization	Level IV Level III (indicators)	Grab Samples

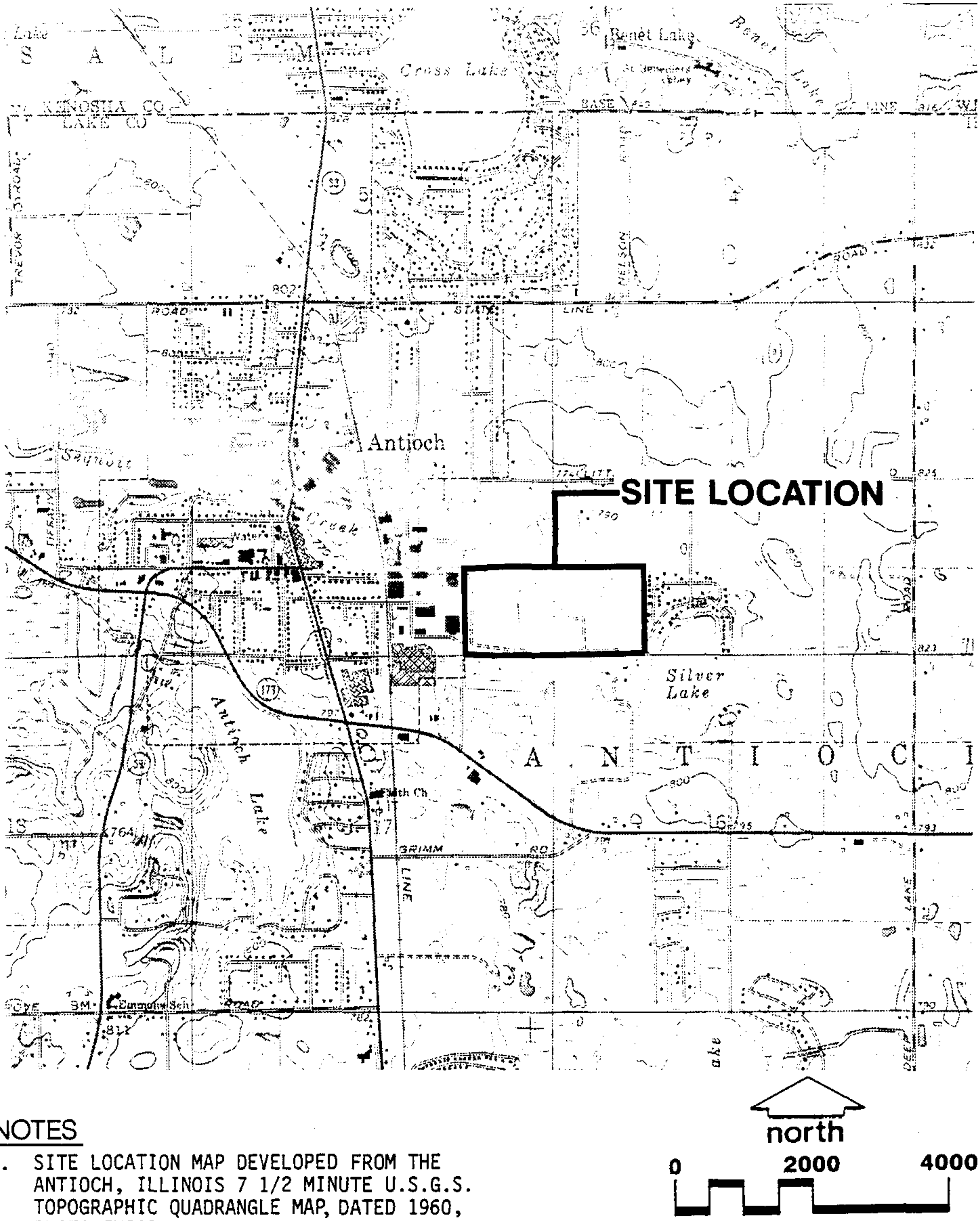
TABLE 10

Analytical Data Quality Objectives Description

Level	Description
Level V	Non-standard methods. Analyses which may require method modification and/or development. CLP Special Analytical Services (SAS) are considered Level V.
Level IV	CLP Routine Analytical Services (RAS). This level is characterized by rigorous QA/QC protocols and documentation and provides qualitative and quantitative analytical data. EPA Regional laboratories, university laboratories, or commercial laboratories may provide similar support but may be subject to EPA performance auditing and approval prior to use.
Level III	Laboratory analysis using methods other than the CLP RAS. This level is used primarily in support of engineering studies using standard EPA approved procedures. Some procedures may be equivalent to CLP RAs without the CLP requirements for documentation and QA/QC.
Level II	Field analysis. This level is characterized by the use of portable analytical instruments which can be used on-site or in mobile laboratories stationed near a site (close-support labs). Depending upon the types of contaminants, sample matrix and personnel skill, qualitative and quantitative data can be obtained.
Level I	Field screening. This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations and for health and safety support. Data can be generated regarding the presence or absence of certain contaminants (especially volatiles) at sampling locations.

NOTE: The analytical levels described by designations I through V are based on the sophistication of the technologies used and documentation provided, as described in Data Quality Objectives for Remedial Response Activities, EPA 540/G-87/003, March 1987.

FIGURES



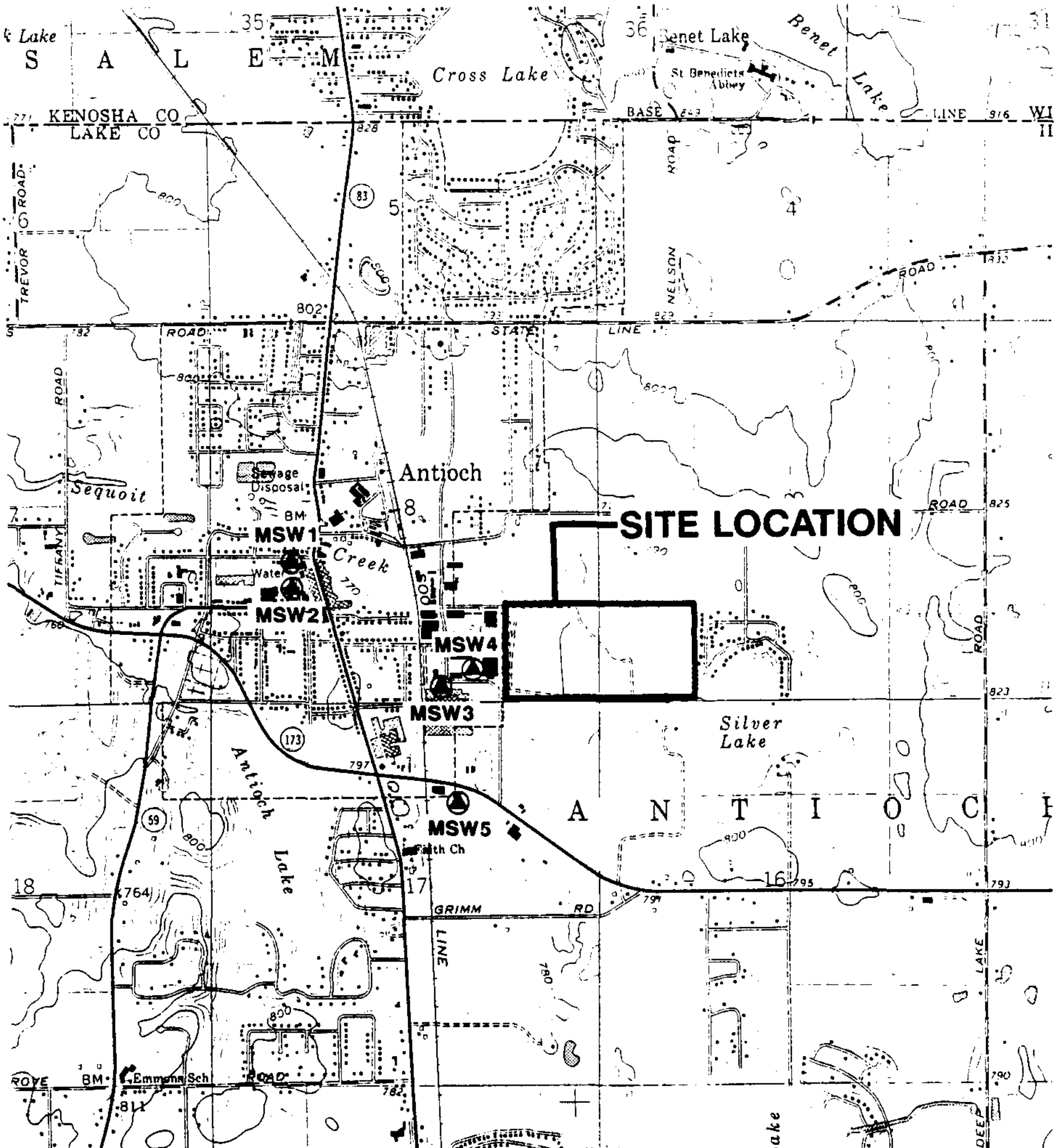
QUALITY CONTROL
	INITIALS		INITIALS
Drafting Standards	DLF 10-22-90	PM	GEP 10-22-90
Professional	AJS	Division	DWH
Section	RM	Other	

NOTES

1. SITE LOCATION MAP DEVELOPED FROM THE ANTIOCH, ILLINOIS 7 1/2 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP, DATED 1960, PHOTOREVISED 1972.

FIGURE 1

WARZYN	SITE LOCATION MAP	Drawn HLH	Checked RJM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL, RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90
				60953 A1



LEGEND

MSW1 VILLAGE WATER SUPPLY WELL LOCATION AND NUMBER

NOTES

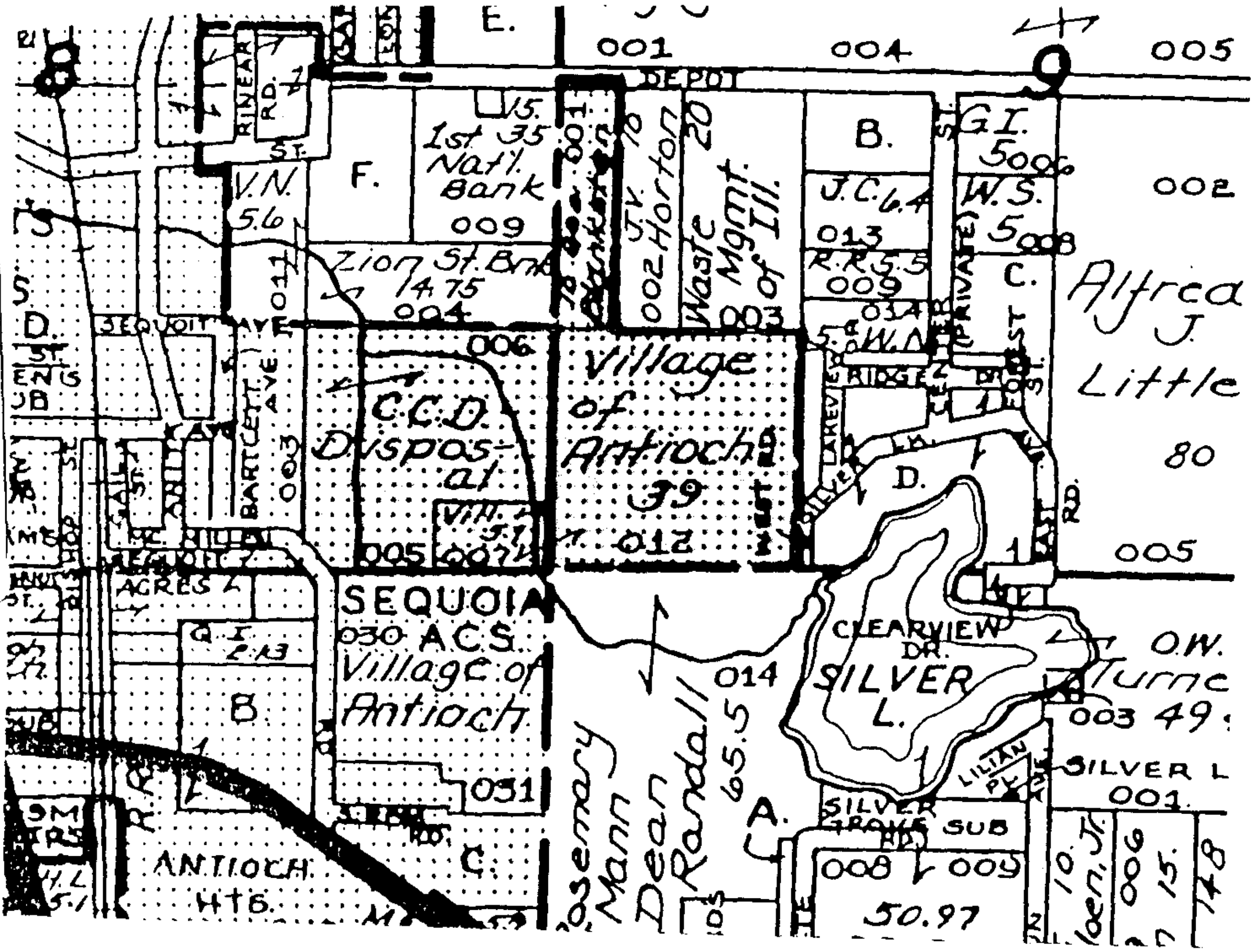
1. SITE LOCATION MAP DEVELOPED FROM THE ANTIOCH, ILLINOIS 7 1/2 MINUTE U.S.G.S. TOPOGRAPHIC QUADRANGLE MAP, DATED 1960, PHOTOREVISED 1972.

FIGURE 2

WARZYN	VILLAGE WATER SUPPLY WELL LOCATION MAP	Drawn HLH	Checked RJM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL, RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90
				60953 A2

QUALITY CONTROL

	INITIAL	DATE		INITIAL	DATE
Drafting Standards	DLF	10-22-90 PM	Division	GEP	10-22-90
Lead Professional	AJS		Other	DWH	
Section	RM				



LEGEND

SITE LOCATION

NOTES

1. BASE MAP DEVELOPED FROM THE LAKE COUNTY LAND ATLAS & PLAT BOOK, DATED 1986, PUBLISHED BY ROCKFORD MAP PUBLISHERS, INC.

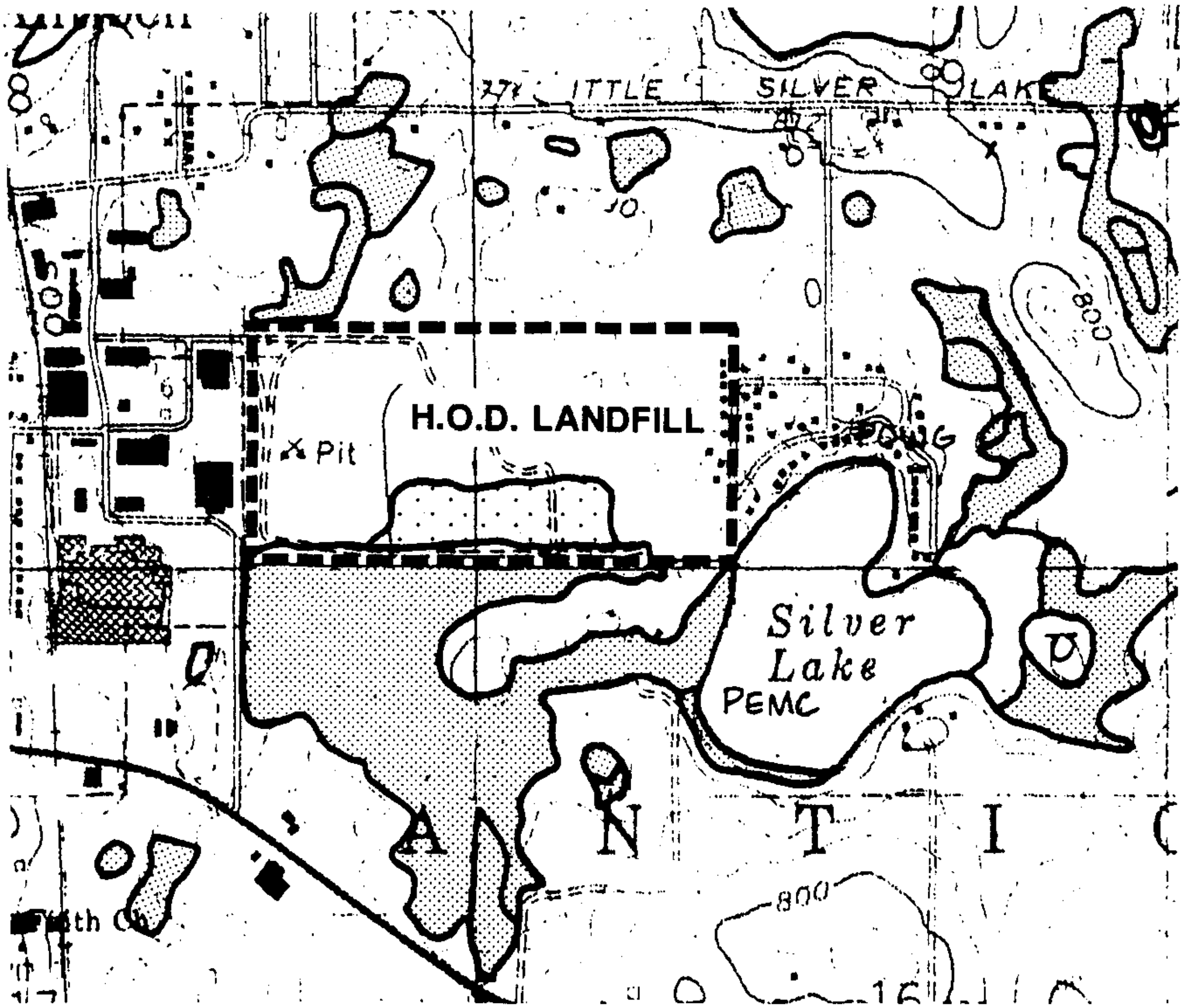
north

0 1000 2000

SCALE IN FEET

FIGURE 3

WARZYN	PROPERTY OWNERSHIP MAP	Drawn DLF	Checked RJM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL, RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90 60953 A6



LEGEND

SEASONAL WETLAND 1, 2

WETLAND 1, 2

NOTES

1. WETLANDS INVENTORY MAP DEVELOPED FROM THE ANTIOCH, ILLINOIS 7 1/2 MINUTE NATIONAL WETLANDS INVENTORY MAP, DATED OCTOBER 1980.

2. WETLAND AREAS IDENTIFIED BY ANALYSIS OF HIGH ALTITUDE AERIAL PHOTOGRAPY. AREAS HAVE NOT BEEN FIELD VERIFIED.

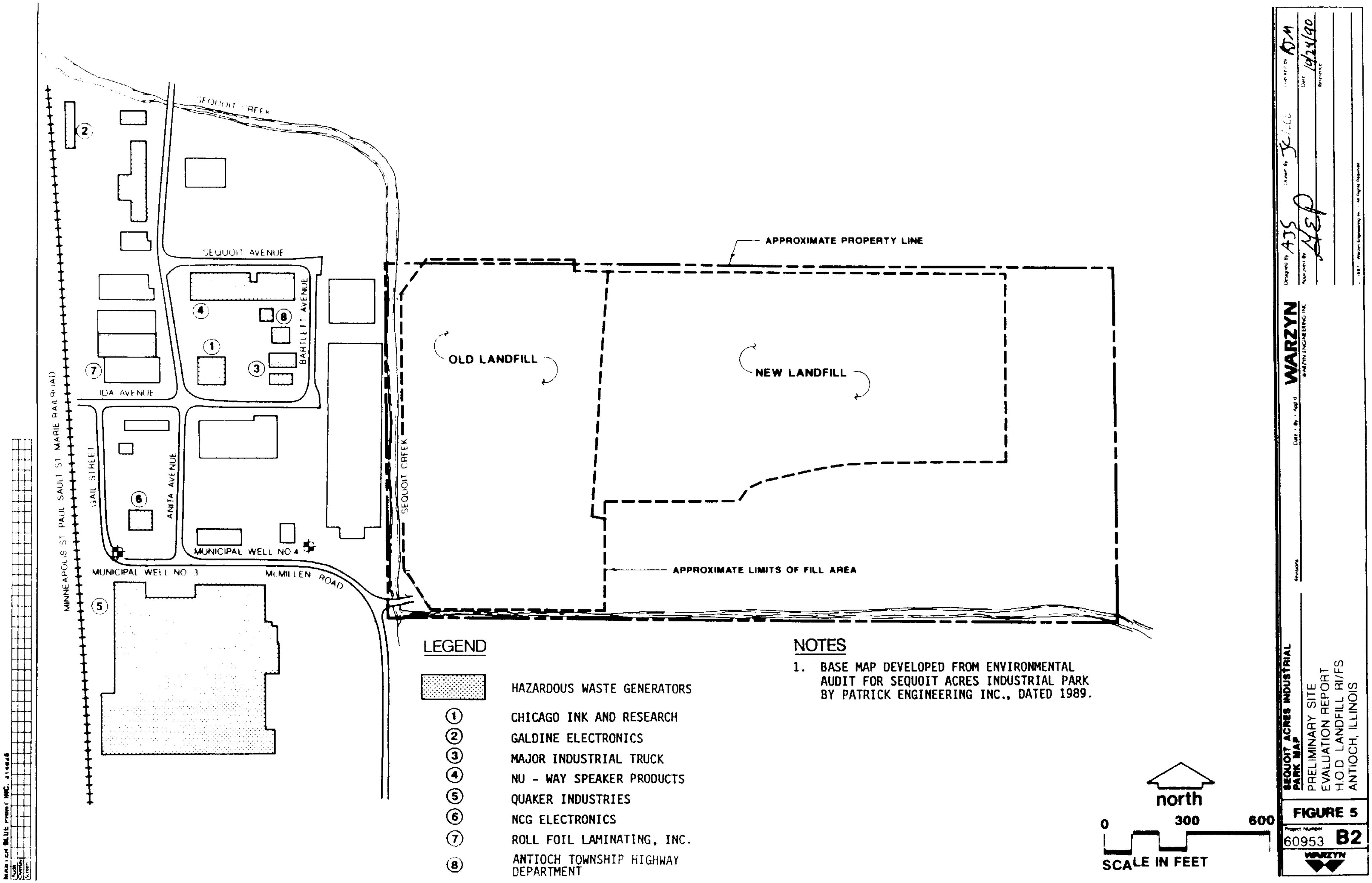
north

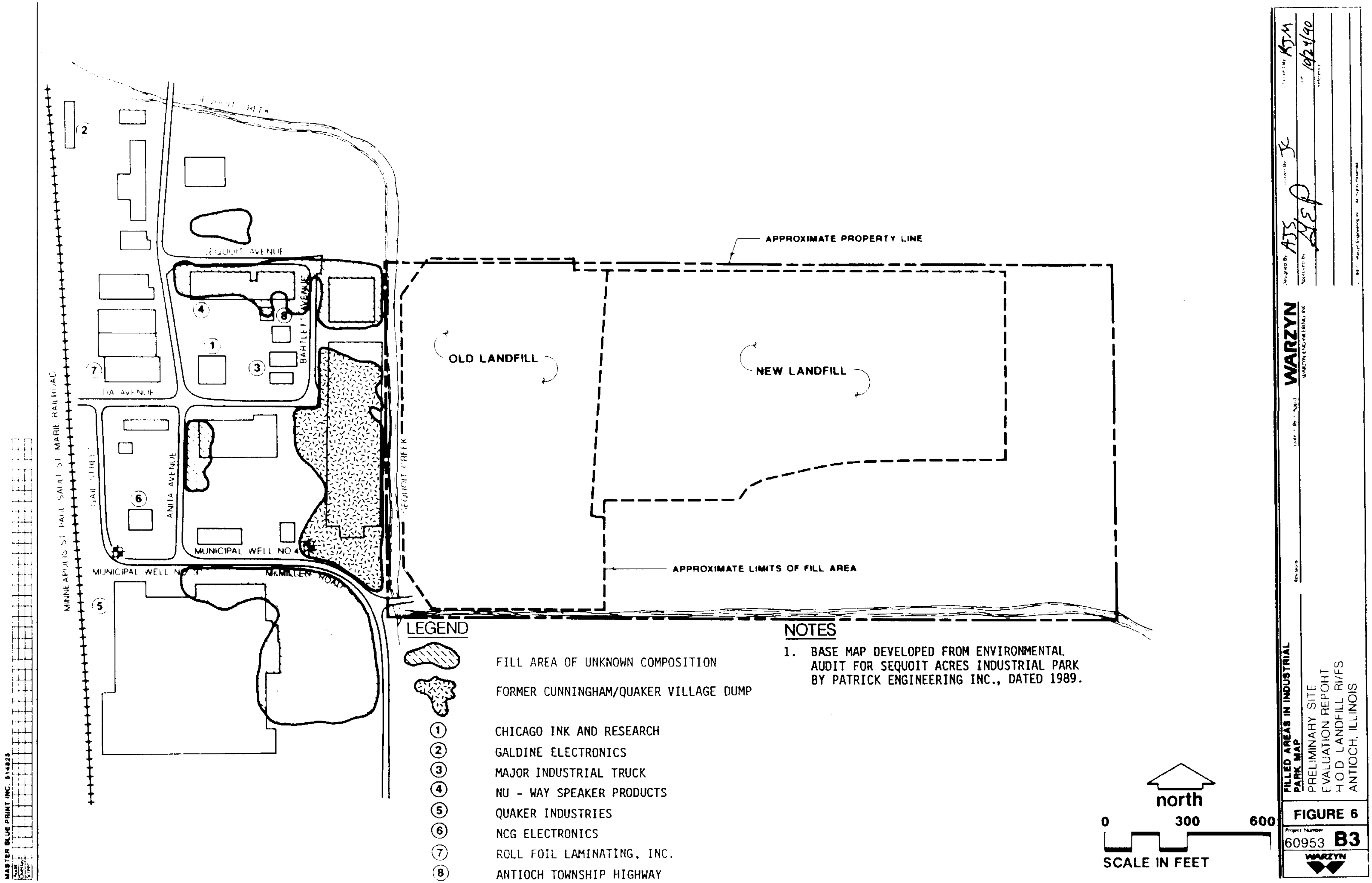
0 1000 2000

SCALE IN FEET

FIGURE 4

WARZYN	WETLANDS INVENTORY MAP	Drawn JC	Checked RJM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90
				60953 A5


SEQUOIT CREEK
SEQUOIT AVENUE
BARTLETT AVENUE
IDA AVENUE
GAIL STREET
ANITA AVENUE
MINNEAPOLIS ST PAUL SAULT ST MARIE RAILROAD
MUNICIPAL WELL NO 4
MUNICIPAL WELL NO 3
McMILLEN ROAD
APPROXIMATE PROPERTY LINE
OLD LANDFILL
NEW LANDFILL
APPROXIMATE LIMITS OF FILL AREA
LEGEND
HAZARDOUS WASTE GENERATORS
1 CHICAGO INK AND RESEARCH
2 GALDINE ELECTRONICS
3 MAJOR INDUSTRIAL TRUCK
4 NU - WAY SPEAKER PRODUCTS
5 QUAKER INDUSTRIES
6 NCG ELECTRONICS
7 ROLL FOIL LAMINATING, INC.
8 ANTIOCH TOWNSHIP HIGHWAY DEPARTMENT
NOTES
1. BASE MAP DEVELOPED FROM ENVIRONMENTAL AUDIT FOR SEQUOIT ACRES INDUSTRIAL PARK BY PATRICK ENGINEERING INC., DATED 1989.
north
0 300 600
SCALE IN FEET
WARZYN
SEQUOIT ACRES INDUSTRIAL PARK MAP
PRELIMINARY SITE EVALUATION REPORT
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS
FIGURE 5
60953 B2
10/24/90


SEQUOIT AVENUE
IDA AVENUE
BARTLETT AVENUE
ANITA AVENUE
GAIL STREET
MINNEAPOLIS ST PAUL SAULT ST MARIE RAILROAD
MUNICIPAL WELL NO 4
MUNICIPAL WELL NO 3
McMILLEN ROAD
SEQUOIT CREEK
APPROXIMATE PROPERTY LINE
OLD LANDFILL
NEW LANDFILL
APPROXIMATE LIMITS OF FILL AREA
LEGEND
FILL AREA OF UNKNOWN COMPOSITION
FORMER CUNNINGHAM/QUAKER VILLAGE DUMP
1 CHICAGO INK AND RESEARCH
2 GALDINE ELECTRONICS
3 MAJOR INDUSTRIAL TRUCK
4 NU - WAY SPEAKER PRODUCTS
5 QUAKER INDUSTRIES
6 NCG ELECTRONICS
7 ROLL FOIL LAMINATING, INC.
8 ANTIOCH TOWNSHIP HIGHWAY DEPARTMENT
NOTES
1. BASE MAP DEVELOPED FROM ENVIRONMENTAL AUDIT FOR SEQUOIT ACRES INDUSTRIAL PARK BY PATRICK ENGINEERING INC., DATED 1989.
north
0 300 600
SCALE IN FEET
WARZYN
FILLED AREAS IN INDUSTRIAL PARK MAP
PRELIMINARY SITE EVALUATION REPORT
H O D LANDFILL RI/FS
ANTIOCH, ILLINOIS
FIGURE 6
60953 B3
WARZYN

SOIL LEGEND

A number shows the soil type or a group of undifferentiated soils. A capital letter, A, B, C, D, E, F, or G, shows the slope. W preceding the number shows a wet soil. Most symbols without a slope letter are those of nearly level soils. A final number, 2, after the slope letter indicates an eroded soil.

SYMBOL	NAME
25F	Hennepin loam, 15 to 30 percent slopes
25G	Hennepin loam, 30 to 60 percent slopes
27B	Miami silt loam, 2 to 4 percent slopes
27C	Miami silt loam, 4 to 7 percent slopes
27C2	Miami silt loam, 4 to 7 percent slopes, eroded
27D	Miami silt loam, 7 to 12 percent slopes
27D2	Miami silt loam, 7 to 12 percent slopes, eroded
V54	Plainfield sand, slightly acid variant, 1 to 4 percent slopes
57B	Montmorenci silt loam, 2 to 4 percent slopes
57C2	Montmorenci silt loam, 4 to 7 percent slopes, eroded
67	Harpster silty clay loam
93F	Rodman gravelly loam, 15 to 50 percent slopes
W97	Houghton peat, wet
103	Houghton muck
W103	Houghton muck, wet
107	Sawmill silty clay loam
146A	Elliott silt loam, 0 to 2 percent slopes
146B	Elliott silt loam, 2 to 4 percent slopes
153	Pella silty clay loam
189A	Martinton silt loam, 0 to 2 percent slopes
189B	Martinton silt loam, 2 to 4 percent slopes
192A	Del Rey silt loam, 0 to 2 percent slopes
192B	Del Rey silt loam, 2 to 4 percent slopes
194B	Morley silt loam, 2 to 4 percent slopes
194B2	Morley silt loam, 2 to 4 percent slopes, eroded
194C	Morley silt loam, 4 to 7 percent slopes
194C2	Morley silt loam, 4 to 7 percent slopes, eroded
194D	Morley silt loam, 7 to 12 percent slopes
194D2	Morley silt loam, 7 to 12 percent slopes, eroded
194E	Morley silt loam, 12 to 25 percent slopes
194E2	Morley silt loam, 12 to 25 percent slopes, eroded
232	Ashkum silty clay loam
228A	Nappanee silt loam, 0 to 2 percent slopes
228B	Nappanee silt loam, 2 to 4 percent slopes
228C2	Nappanee silt loam, 4 to 7 percent slopes, eroded
298A	Beecher silt loam, 0 to 2 percent slopes
298B	Beecher silt loam, 2 to 4 percent slopes
320A	Frankfort silt loam, 0 to 2 percent slopes
320B	Frankfort silt loam, 2 to 4 percent slopes
323C2	Casco loam, 3 to 10 percent slopes, eroded
325A	Dresden loam, 0 to 2 percent slopes
325B	Dresden loam, 2 to 4 percent slopes
327A	Fox loam, 0 to 2 percent slopes
327B	Fox loam, 2 to 4 percent slopes
327C2	Fox loam, 4 to 7 percent slopes, eroded
327D2	Fox loam, 7 to 12 percent slopes, eroded
330	Peotone silty clay loam
W330	Peotone silty clay loam, wet

SYMBOL	NAME
365	Aptakisic silt loam
367	Beach sand
370B	Saylesville silt loam, 1 to 4 percent slopes
370C2	Saylesville silt loam, 4 to 7 percent slopes, eroded
442A	Mundelein silt loam, 0 to 2 percent slopes
442B	Mundelein silt loam, 2 to 4 percent slopes
443A	Barrington silt loam, 0 to 2 percent slopes
443B	Barrington silt loam, 2 to 4 percent slopes
465	Montgomery silty clay
490A	Odell silt loam, 0 to 2 percent slopes
490B	Odell silt loam, 2 to 4 percent slopes
495A	Corwin silt loam, 0 to 2 percent slopes
495B	Corwin silt loam, 2 to 4 percent slopes
513	Granby loamy fine sand
531B	Markham silt loam, 1 to 4 percent slopes
531B2	Markham silt loam, 2 to 4 percent slopes, eroded
531C	Markham silt loam, 4 to 7 percent slopes
531C2	Markham silt loam, 4 to 7 percent slopes, eroded
531D2	Markham silt loam, 7 to 12 percent slopes, eroded
696A	Zurich silt loam, 0 to 2 percent slopes
696B	Zurich silt loam, 2 to 4 percent slopes
696C	Zurich silt loam, 4 to 7 percent slopes
696C2	Zurich silt loam, 4 to 7 percent slopes, eroded
696D2	Zurich silt loam, 7 to 15 percent slopes, eroded
697A	Wauconda silt loam, 0 to 2 percent slopes
697B	Wauconda silt loam, 2 to 4 percent slopes
698A	Grays silt loam, 0 to 2 percent slopes
698B	Grays silt loam, 2 to 4 percent slopes
706B	Boyer sandy loam, 1 to 4 percent slopes
706C2	Boyer sandy loam, 4 to 10 percent slopes, eroded
978A	Wauconda and Beecher silt loams, 0 to 2 percent slopes
978B	Wauconda and Beecher silt loams, 2 to 4 percent slopes
979A	Grays and Markham silt loams, 0 to 2 percent slopes
979B	Grays and Markham silt loams, 2 to 4 percent slopes
980B	Zurich and Morley silt loams, 2 to 4 percent slopes
980C2	Zurich and Morley silt loams, 4 to 7 percent slopes, eroded
981A	Wauconda and Frankfort silt loams, 0 to 2 percent slopes
981B	Wauconda and Frankfort silt loams, 2 to 4 percent slopes
982A	Aptakisic and Nappanee silt loams, 0 to 2 percent slopes
982B	Aptakisic and Nappanee silt loams, 2 to 4 percent slopes
983B	Zurich and Nappanee silt loams, 2 to 4 percent slopes
984B	Barrington and Varna silt loams, 2 to 4 percent slopes
989A	Mundelein and Elliott silt loams, 0 to 2 percent slopes
989B	Mundelein and Elliott silt loams, 2 to 4 percent slopes
BA	Borrow area
GP	Gravel pits
MA	Marsh
ML	Made land

NOTES

1. SCS SOILS MAP WAS OBTAINED FROM THE SOIL SURVEY OF LAKE COUNTY, ILLINOIS, DATED SEPTEMBER 1970.

north

0 1000 2000

SCALE IN FEET (APPROX.)

Designed by AJS

Approved by MEP

10/24/90

WARZYN

WARZYN ENGINEERING INC.

Revisions

SURFICIAL SOILS MAP

PRELIMINARY SITE EVALUATION REPORT
H.O.D. LANDFILL, RI/FS
ANTIOCH, ILLINOIS

FIGURE 7

Project Number 60953 B1

WARZYN

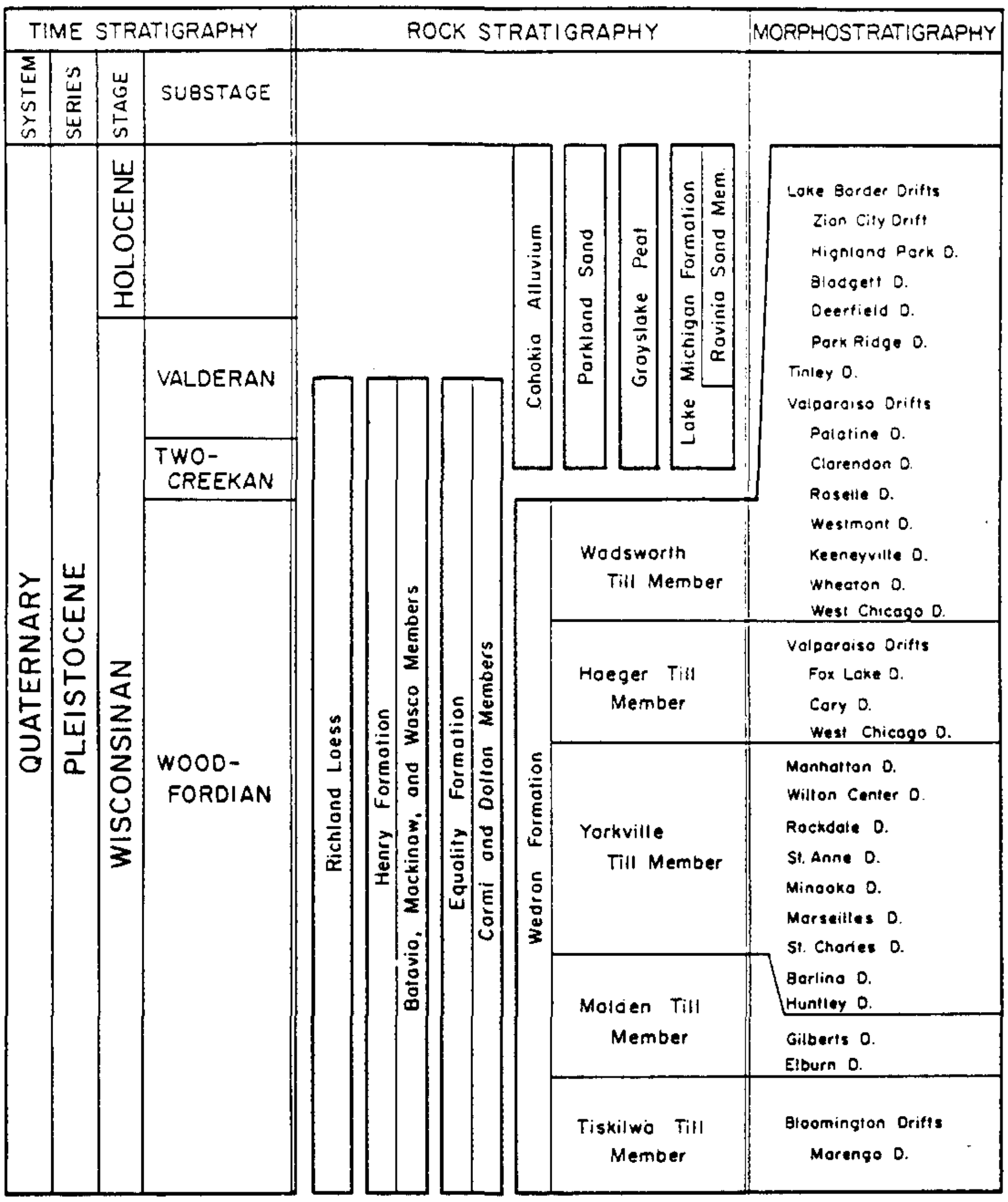
SYSTEM	SERIES	GROUP OR FORMATION	AQUIFER	LOG	THICKNESS (FT)	DESCRIPTION
QUATERNARY	PLEISTOCENE		Sands and Gravels		90-325	Unconsolidated glacial deposits pebbly clay (till), silt, sand and gravel Alluvial silts and sands along streams
					Fissure Fillings	Shale, sandy, brown to black
SILURIAN	NIAGARAN	Racine	Silurian Shallow dolomite aquifer	reef	0-180	Dolomite, very pure to argillaceous, silty, cherty; reefs in upper part
		Sugar Run				Dolomite, slightly argillaceous and silty
		Joliet				Dolomite, very pure to shaly and shale, dolomitic; white, light gray, green, pink, maroon
	ALEXANDRIAN	Kankakee			0-90	Dolomite, pure top 1'-2', thin green shale partings, base glauconitic
		Elwood				Dolomite, slightly argillaceous, abundant layered white chert
		Wilhelmi				Dolomite, gray, argillaceous and becomes dolomitic shale at base
ORDOVICIAN	CINCINNATIAN	Maquoketa			100-240	Shale, red; oolites Shale, silty, dolomitic, greenish gray, weak (Upper unit) Dolomite and limestone, white, light gray, interbedded shale (Middle unit) Shale, dolomitic, brown, gray (Lower unit)
	CHAMPLAINIAN	Galena	Galena-Platteville Cambrian-Ordovician aquifer		270-335	Dolomite, and/or limestone, cherty (Lower part)
		Platteville				Dolomite, shale partings, speckled Dolomite and/or limestone, cherty, sandy at base
		Glenwood	Glenwood-St. Peter		165-300	*Sandstone, fine and coarse grained; little dolomite; shale at top*
		St. Peter				Sandstone, fine to medium grained; locally cherty red shale at base
CAMBRIAN	CROIXAN	Eminence	Eminence Potosi		0-100	Dolomite, light colored, sandy, thin sandstones
		Potosi				Dolomite, fine-grained, gray to brown, drusy quartz
		Franconia	Franconia		40-80	Dolomite, sandstone and shale, glauconitic, green to red, micaceous
		Ironton	*Ironton-Galesville*		100-190	*Sandstone, fine to coarse grained, well sorted; upper part dolomitic*
		Galesville				
		Eau Claire			385-475	Shale and siltstone, dolomitic, glauconitic; sandstone, dolomitic, glauconitic
		Elmhurst Member	Elmhurst-Mt. Simon Elmhurst-Mt. Simon aquifer		1200-2000	Sandstone, coarse grained, white, red in lower half; lenses of shale and siltstone, red, micaceous
		Mt. Simon				
PRE-CAMBRIAN						Granitic Rocks

NOTES

1. STRATIGRAPHIC COLUMN ADAPTED FROM PUBLIC GROUNDWATER SUPPLIES IN LAKE COUNTY, ILLINOIS. STATE WATER SURVEY, URBANA, ILLINOIS BY DOROTHY M. WOLLER AND JAMES P. GIBB, 1976.

FIGURE 8

WARZYN	STRATIGRAPHIC COLUMN FOR NORTHEASTERN ILLINOIS	Drawn HLH	Checked RJM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL, RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90 60953 **A3**



NOTES

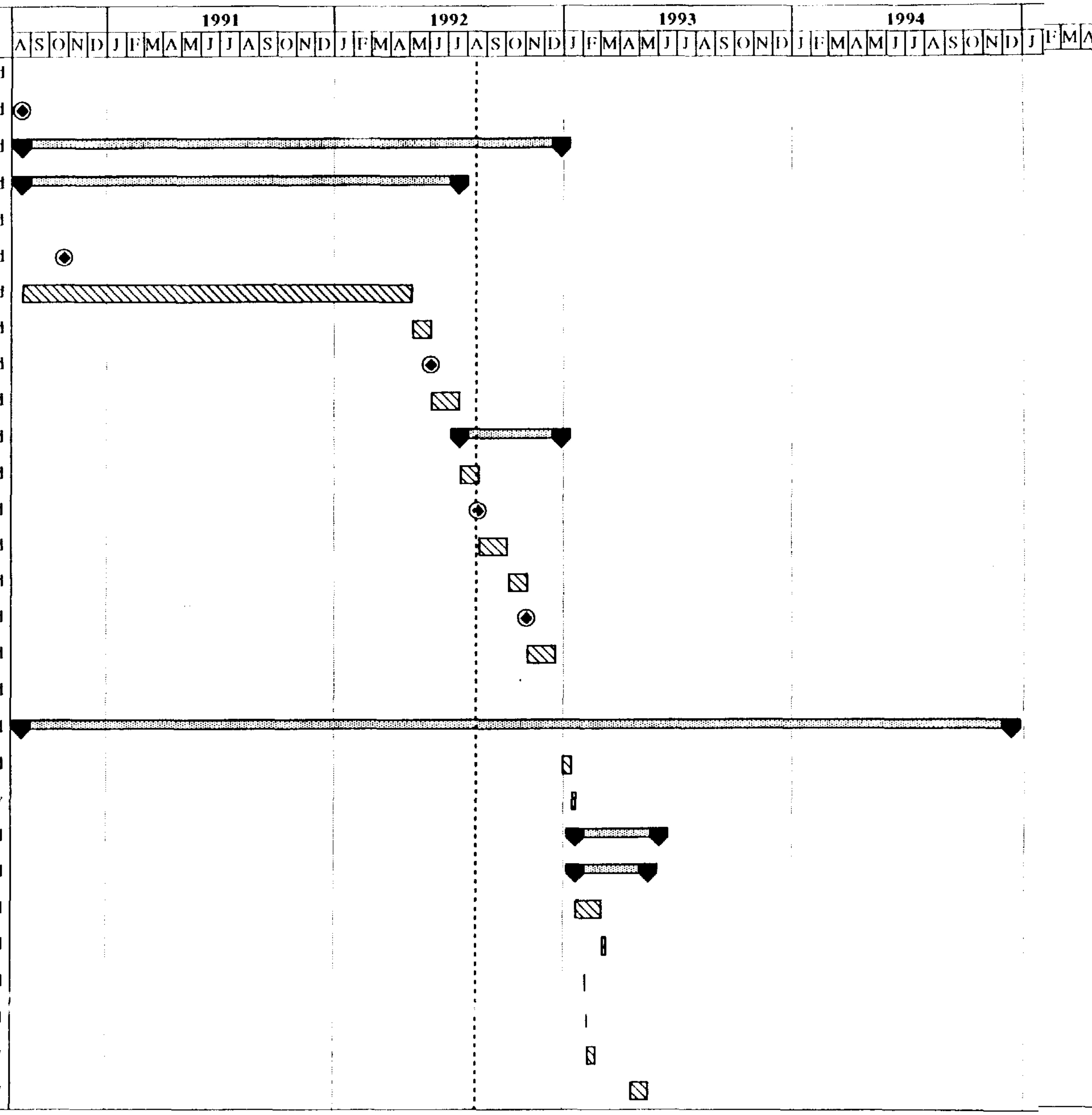
1. STRATIGRAPHIC COLUMN TAKEN FROM SUMMARY OF THE GEOLOGY OF THE CHICAGO AREA. ILLINOIS STATE GEOLOGICAL SURVEY CIRCULAR 460 BY H. B. WILLMAN.

FIGURE 9

WARZYN	**PLEISTOCENE STRATIGRAPHIC COLUMN FOR CHICAGO AREA**	Drawn HLH	Checked RSM	App'd. AJS
	PRELIMINARY SITE EVALUATION REPORT H.O.D. LANDFILL, RI/FS ANTIOCH, ILLINOIS	Revisions		Date 10/24/90 60953 **A4**

FIGURE 10
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS

ID	Name	Duration
1	HOD LANDFILL RI/FS	0ed
2	Admin. Order by Consent Signed	0d
3	PLANNING DOCUMENTS	862.38ed
4	TASK 1: Work Plan	699ed
5	Prepare Draft Work Plans (WPs)	1d
6	Draft WPs (PSER/TS) to EPA	0d
7	EPA Review/Comment	45ed
8	Revise PSER/TS	30ed
9	Final PSER/TS to EPA	0d
10	EPA Review/Approve PSER/TS	45ed
11	TASK 2: Project Plans	162.38ed
12	Prepare draft Project Plans (PPs)	30ed
13	Draft PPs to EPA	0d
14	EPA Review/Comment on PPs	45ed
15	Revise PPs	30ed
16	Final PPs to EPA	0d
17	EPA Review/Approve PPs	45ed
18	Meeting w/ WMII & EPA	1d
19	REMEDIAL INVESTIGATION	1575ed
20	Mobilization to Site	10d
21	Prepare Staging Area	1w
22	TASK 3: Site Investigation (Phase I)	134.38ed
23	Physical Characterization	116.38ed
24	Hydrogeologic Eval.	30d
25	Hydrologic Evaluation	5d
26	Soil/Sediment Evaluation	2d
27	Air Evaluation	1d
28	Human Population Evaluation	2w
29	Ecological Evaluation	4w



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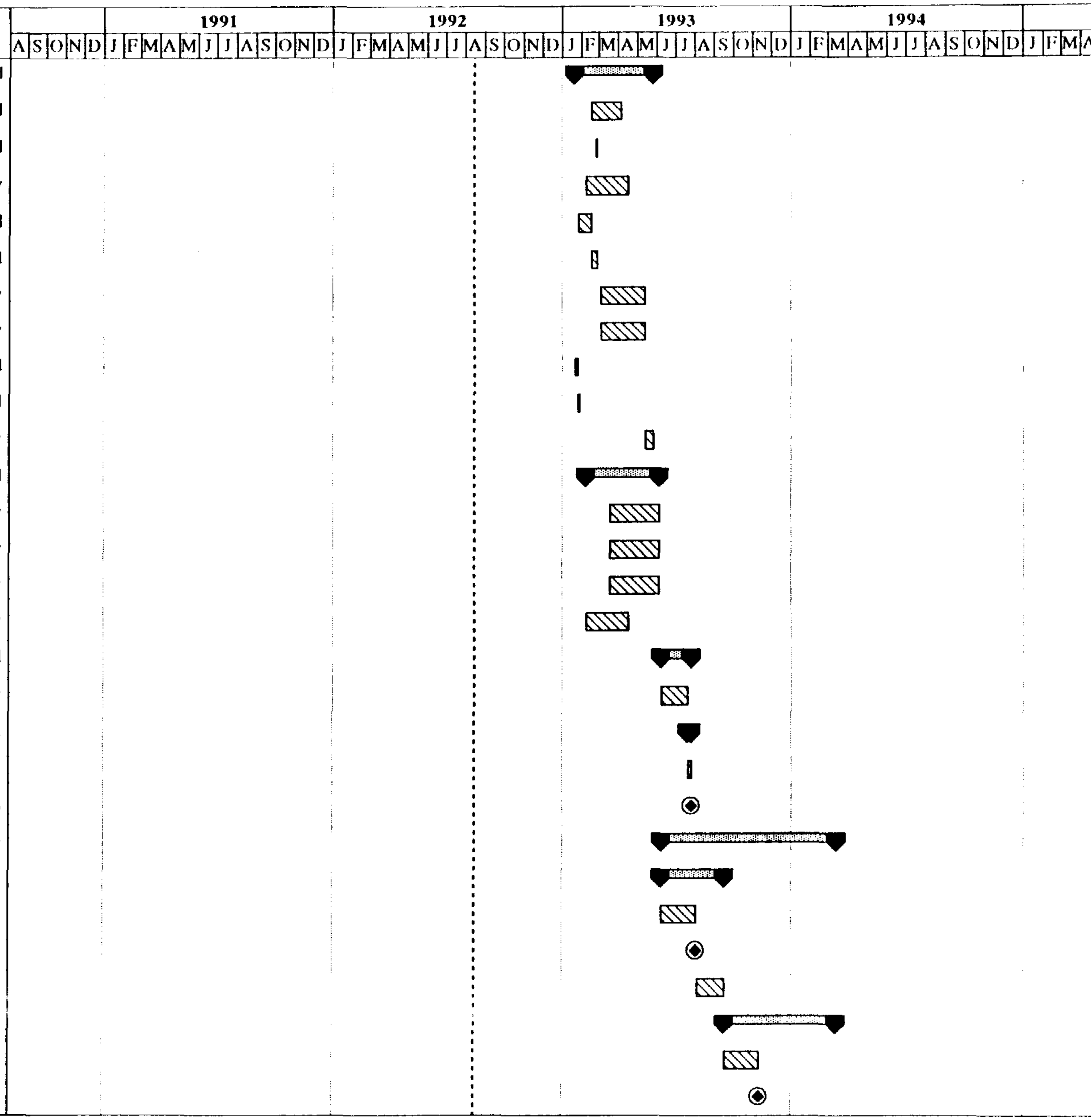
Date: 8/12/92
Page:1

Scheduled Activity | **Milestone** | **Critical Path** | **Summary**

d = work days ed = elapsed calendar days w = work weeks

FIGURE 10
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS

ID	Name	Duration
30	Source Characterization	125.38ed
31	Cap Evaluation	34d
32	Leach Collect Sys. Eval	2d
33	On-Site Soil/Sed. Sampling/Analysis	10w
34	Leachate Piez./Gas Probes	16d
35	Downhole Gamma Logging	8d
36	Landfill Gas Sampling/Analysis	10w
37	Leachate Sampling/Analysis	10w
38	Landfill Borings	3d
39	Construct Perimeter Borings	3d
40	Off-Site Source Evaluation	2w
41	Migration Path./Contaminant Char.	116.38ed
42	Groundwater Sampling/Analysis	11w
43	Private/Muni. Well Sampling/Analysis	11w
44	Surface Water Sampling/Analysis	11w
45	Soil/Sediment Sampling/Analysis	10w
46	TASK 4: Site Investigation Analysis	49.38ed
47	Perform Site Invest. Analysis	6w
48	Tech Memo #1	6.38ed
49	Prepare Memo	1w
50	Tech Memo #1 to EPA	0d
51	TASK 5: Baseline Risk Assessment	278ed
52	Tech Memo #2 (BRA - TWP)	102ed
53	Prepare BRA -TWP	40d
54	BRA - TWP to EPA	0d
55	EPA Review / Comment	45ed
56	Baseline Risk Assessment	176ed
57	Prepare Draft BRA Report	8w
58	Draft BRA Report to EPA	0d



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Date: 8/12/92
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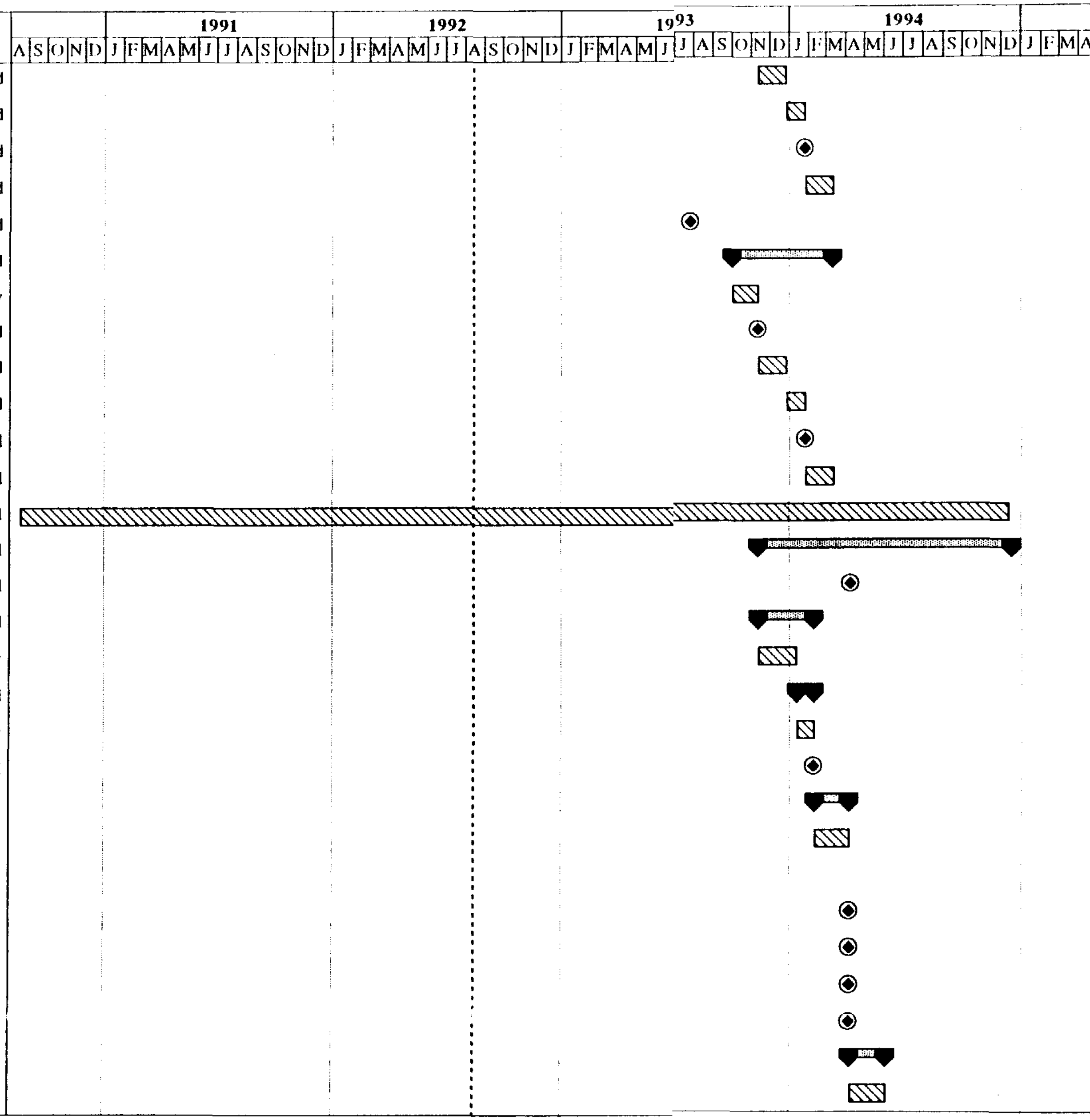
Scheduled Activity | Milestone
Critical Path | Summary

d = work days   ed = elapsed calendar days   w = work weeks

FIGURE 10
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS

ID	Name	Duration
59	EPA Review/Comment	45ed
60	Revise BRA Report	30ed
61	Final BRA Report to EPA	0d
62	EPA Review/Approve BRA	45ed
63	TASK 6: Treatability Studies	0d
64	TASK 7: RI Report	162ed
65	Prepare Draft RI Report	6w
66	Draft RI Report to EPA	0d
67	EPA Review / Comment	45ed
68	Revise RI Report	30ed
69	Final RI Report to EPA	0d
70	EPA Review/Approve RI Report	45ed
71	TASK 8: Community Relations	1575ed
72	FEASIBILITY STUDY	400ed
73	TASK 9: Interim Actions	0d
74	TASK 10: Devlp Rem Act Alt	88.38ed
75	Develop Remedial Alternatives	8w
76	Tech Memo #3 (Altern. Array Doc.)	27.38ed
77	Prepare Memo	4w
78	Tech Memo #3 to EPA	0d
79	TASK 11: Screening Alternatives	55.38ed
80	Screen Alternatives	8w
81	TASK 12: Treat. & Supplemental RI	0ed
82	Prepare SI Work Plan	0d
83	EPA Review/Approve SI WP	0d
84	Conduct Supplemental Investgation	0d
85	Conduct Treatibility Study	0d
86	TASK 13: Detailed Analysis of Alt.	57.38ed
87	Conduct Detailed Analysis	8w



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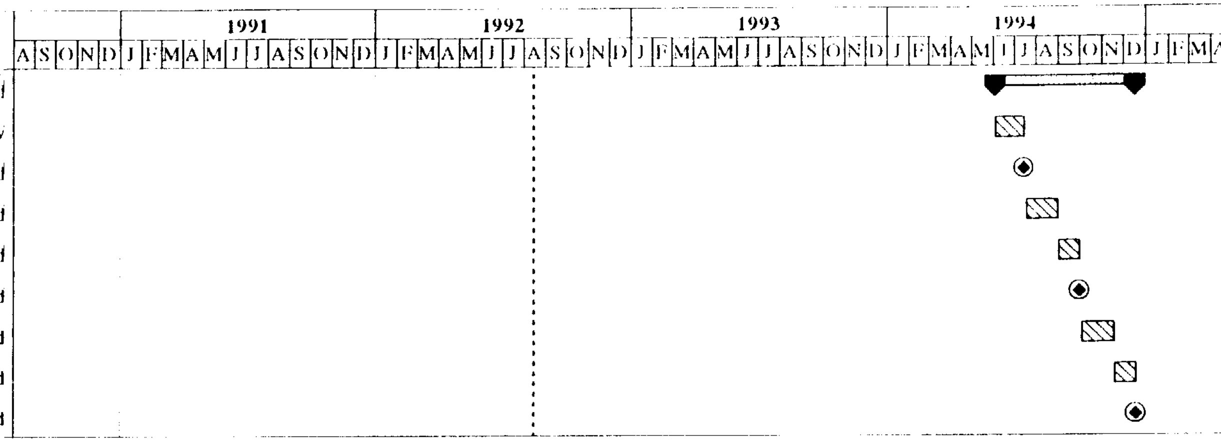
Page:3

Scheduled Activity | Milestone
Critical Path | Summary

d = work days   ed = elapsed calendar days   w = work weeks

FIGURE 10
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS

ID	Name	Duration
88	TASK 14: FS Reports	197ed
89	Prepare Draft FS Report	6w
90	Draft FS Report to EPA	0d
91	EPA Review/Comment	45ed
92	Revise FS Report	30ed
93	Final Draft FS Report to EPA	0d
94	EPA Review FS Report	45ed
95	Revise FS Report	30ed
96	EPA Approval	0d



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Date: 8/12/92
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Scheduled Activity
Critical Path
Milestone
Summary

d = work days ed = elapsed calendar days w = work weeks

WARZYN

Project Organization
H.O.D. Landfill RI/FS

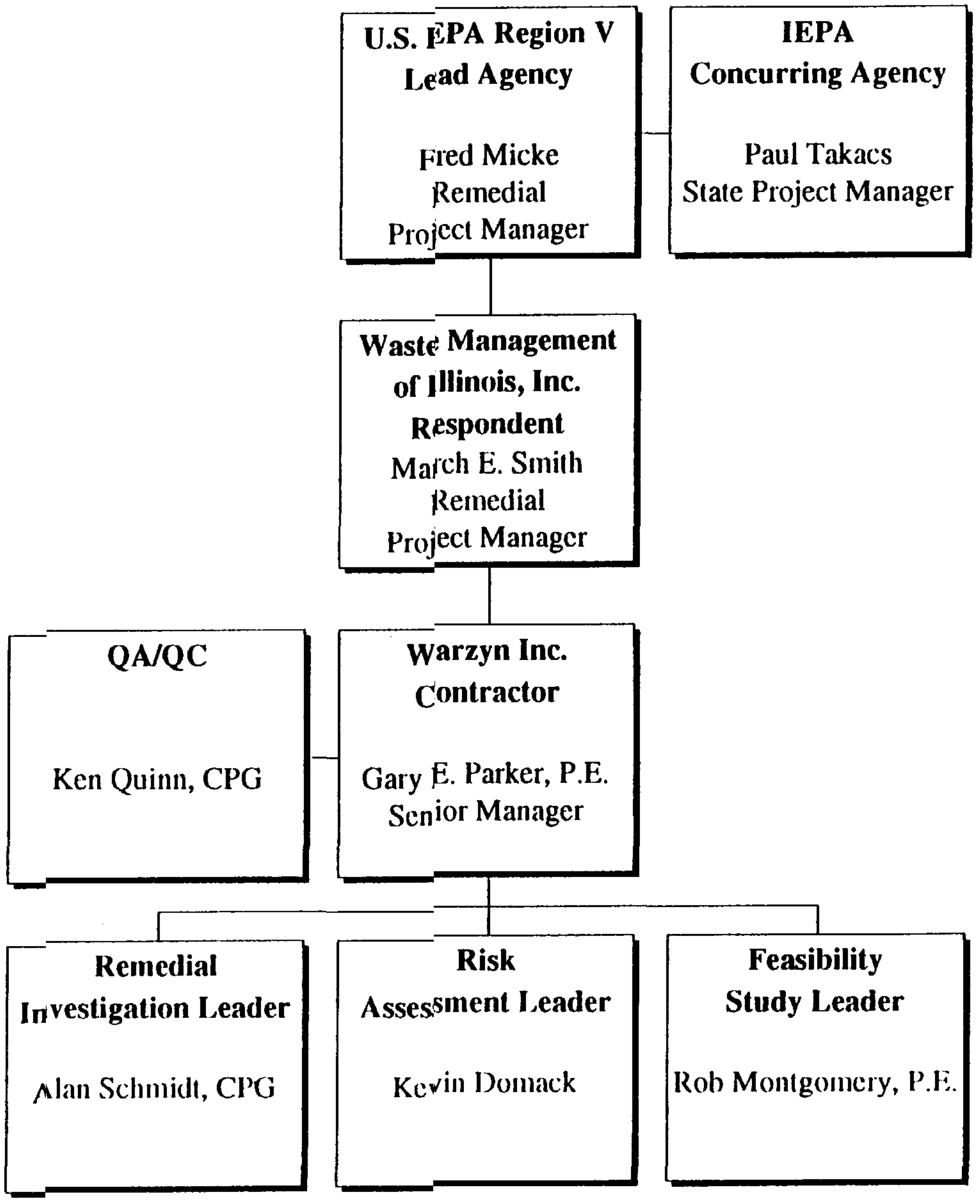
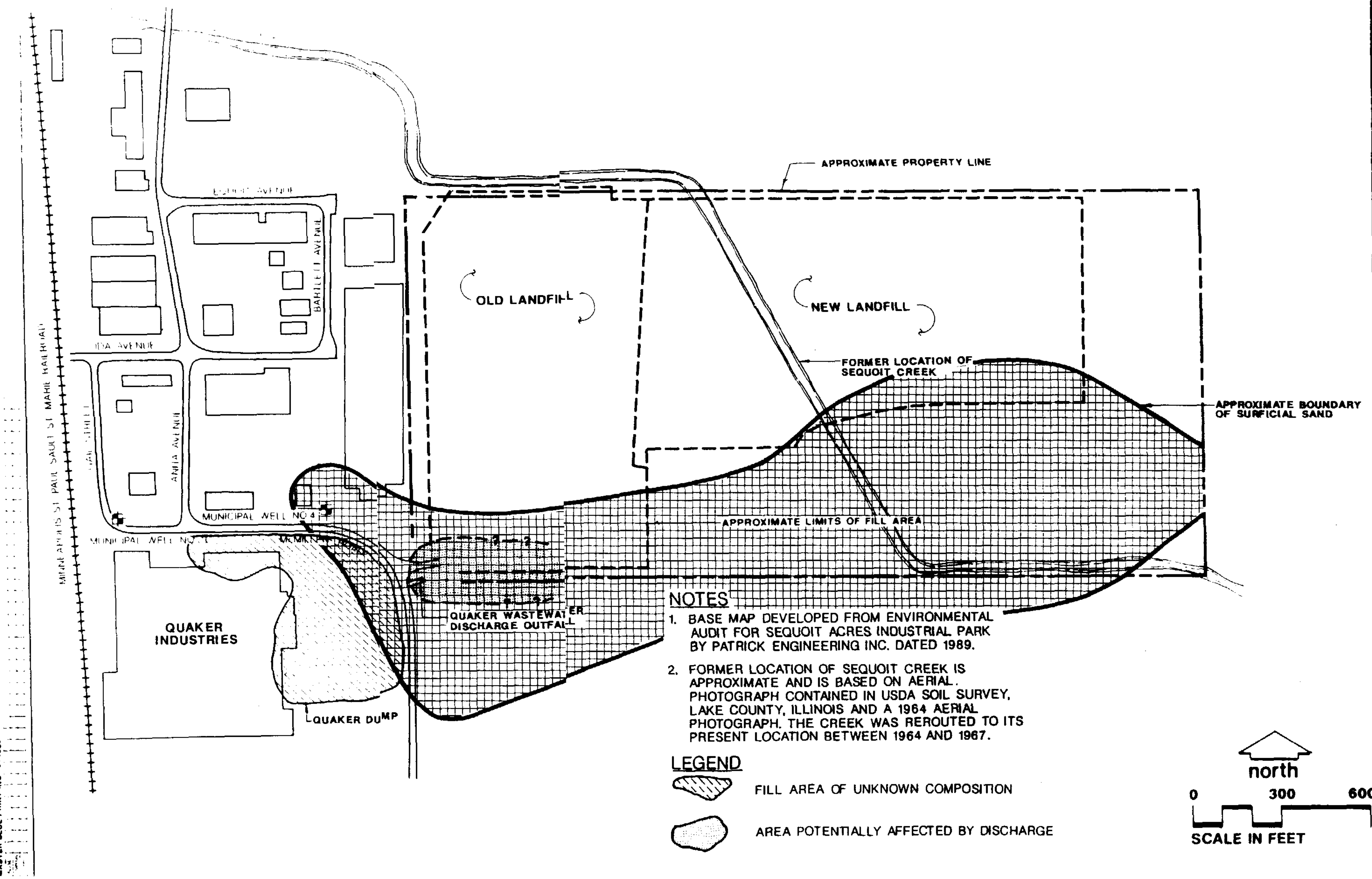


FIGURE 11



NOTES

1. BASE MAP DEVELOPED FROM ENVIRONMENTAL AUDIT FOR SEQUOIT ACRES INDUSTRIAL PARK BY PATRICK ENGINEERING INC. DATED 1989.
2. FORMER LOCATION OF SEQUOIT CREEK IS APPROXIMATE AND IS BASED ON AERIAL PHOTOGRAPH CONTAINED IN USDA SOIL SURVEY, LAKE COUNTY, ILLINOIS AND A 1964 AERIAL PHOTOGRAPH. THE CREEK WAS REROUTED TO ITS PRESENT LOCATION BETWEEN 1964 AND 1967.

LEGEND

FILL AREA OF UNKNOWN COMPOSITION

AREA POTENTIALLY AFFECTED BY DISCHARGE

WARZYN

JK

Gary E. Parker

ASS

2/26/91

QUAKER INDUSTRIES WASTEWATER DISCHARGE

PRELIMINARY SITE EVALUATION REPORT

H.O.D. LANDFILL RI/FS

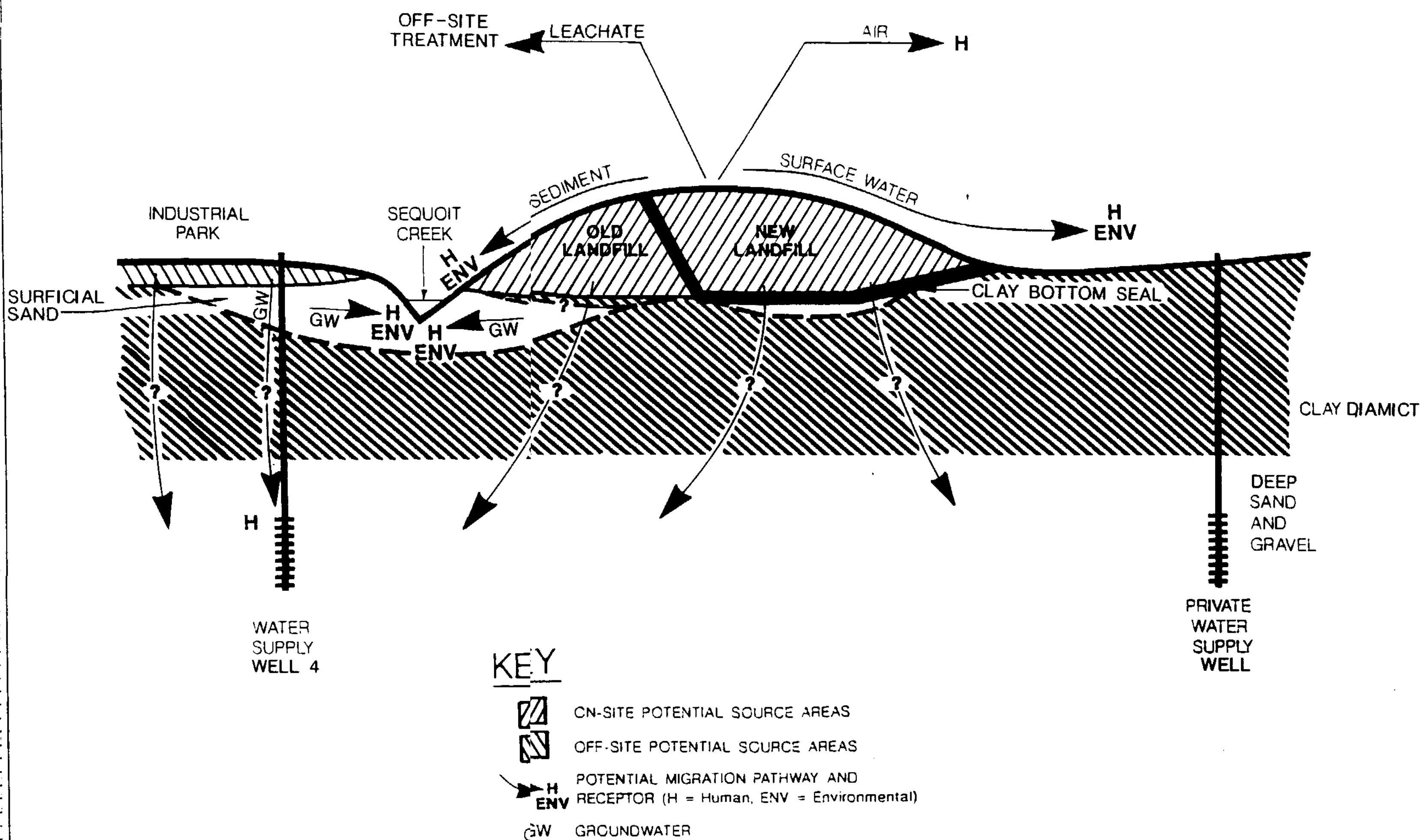
ANTIOCH, ILLINOIS

FIGURE 12

60953 B4

WARZYN

CONCEPTUAL SITE MODEL



WARZYN

CONCEPTUAL SITE MODEL

PRELIMINARY SITE EVALUATION REPORT
H.O.D. LANDFILL RI/FS
ANTIOCH, ILLINOIS

FIGURE 13

60953 B4